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W3b
Spring 1987
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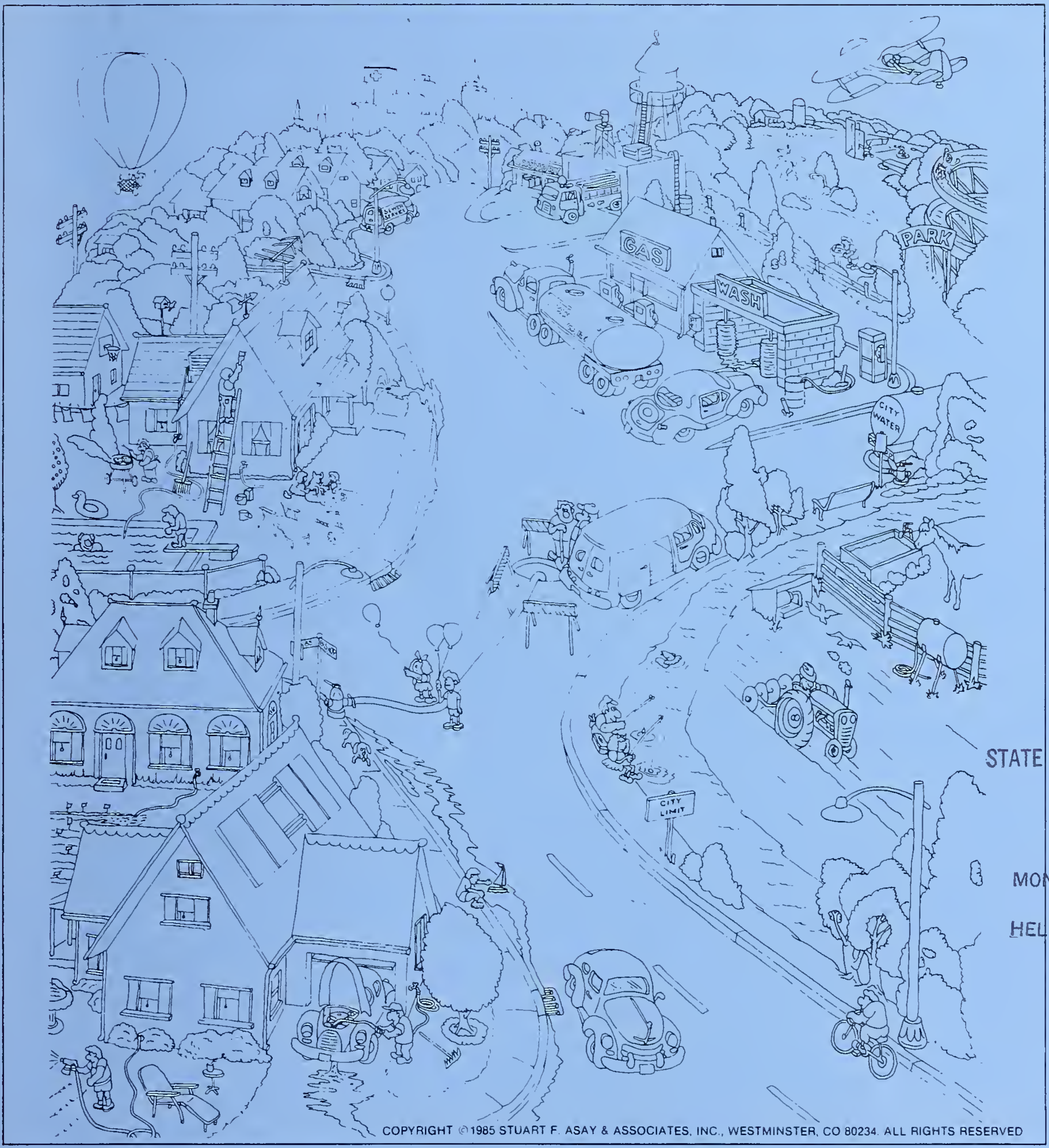
Big Sky Clearwater

SPRING 1987



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Beware of Hidden Contamination Source

Cross-Connections

By: Rick Rosa, Water Quality Bureau

The operator of a public water supply system needs to keep an eye and ear open at all times to make sure that his or her supply system is operated and maintained properly. The supplier needs to know not only how to keep his customer happy but also how to provide a safe product under all conditions.

Since keeping the customer happy is a priority item and most often a full-time job, sometimes the maintenance of the system to assure a safe product is overlooked or neglected. Probably the most frequently overlooked aspect of any maintenance program and most serious in terms of customer safety is the detection and elimination of cross-connections.

Is there really a problem?

The reason for this neglect can sometimes be due to the fact that a cross-connection is not always obvious. Or perhaps this entry point for contamination is apparent but the operator is not able to identify it. Last but not least, the situation may be recognized but not be considered an immediate problem that warrants attention.

An operator of any water system needs to become aware that an existing cross-connection must be eliminated or it could be responsible for the contamination of the entire water supply. Since putting the water customers in the hospital is not exactly suggested practice for good public relations, it may be wise to look at your systems and analyze what (if anything) needs to be done to tighten up your system.

Backflow does occur!

Working for a regulatory agency definitely puts you in a position to hear about all the bad things that can happen to a water supply. We usually learn of these disasters in a round about way; usually after the submittal of unsatisfactory bacteriological samples.

Sometimes we hear from those individuals who just witnessed a contamination episode and are seeking advice on how to clean up the mess. A good example of this is when a farmer siphons spray from his truck into the well when the electricity goes off.

There are also those occasions when a water customer calls and asks what's wrong with so and so's water supply that would cause the water to be green. The point is that backflow does occur and we have the data to document it.

CROSS-CONNECTION DEFINED

Now you are really going to be bored!

One definition used for cross-connection is "any physical arrangement whereby a public water supply system is connected, directly or indirectly, with any non-potable or unapproved water supply system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture, or other device which contains, or may contain, contaminated water, sewage, or other waste or liquid of unknown or unsafe quality which may be capable or imparting contamination to the public water supply as a result of backflow."

Translating this definition from Greek into English creates a relatively short statement. A cross-connection is any point in your water supply system where contamination could enter under the right conditions.

"The right conditions" refers to the pressure situation within the distribution system that would allow a contaminant to enter. This backflow into the system can occur either by backsiphonage or backpressure.

Just like sucking through a straw

Backsiphonage is caused by a negative pressure that allows undesirable liquid or material to be drawn into the system.
The pressure drops responsible for backsiphonage can happen for many different reasons and many of these reasons you are probably aware of. The reasons can be as simple as opening a hydrant or heavy irrigation usage in a particular area. Then again the reason may be hidden for awhile such as in the case of a main break.

Instead of flowing forward, there is a push backward

Backpressure occurs whenever the water supply system is directly connected to another piping system or process operating at a higher system pressure. A backpressure situation is usually obvious such as a non-potable piping system (perhaps an irrigation well, manufacturing process or a boiler system) interconnected with the water supply system.

It must be remembered that every potable water system can be subject to many different pressure situations and therefore any potential inlet for contamination needs to be eliminated or isolated.

POTENTIAL HAZARDS

There are many types of cross-connections and it would be impossible to list every one. Some are very obvious and can be eliminated or protected against. Others you may not be aware of and/or can't do very much about.

As mentioned above, a boiler can send contaminated water back into the potable system due to the high pressure it operates under and it therefore should be connected with a device to prevent backflow.

On the other hand, the siphonage of groundwater back into a main during a break is something that is generally not detected until a bacteriological sample comes back unsatisfactory. Obviously, there is not really anything you can do beforehand to prevent such a situation from occurring.

Check to see if all is okay on the home front

The operator of a system can initiate a program to detect and eliminate potential cross-connection hazards. Such a program should begin with the inspection of the water supply facilities themselves.

Is the well piping in the pumphouse tied to any potential contamination sources such as an irrigation system? If so, is a backflow prevention device provided? Are hose connections in the pumphouse protected to prevent siphonage? Is the water hauling standpipe also protected? Are meter or valve pits drained to daylight or absorption pits underground? The list goes on and on.

What about those potential contamination sources?

After inspection of the supply facilities, the next step is to inventory the commercial and industrial facilities. Such a list should include schools, hospitals, funeral homes, manufacturing outlets, laundromats, car washes, etc. An inspection is necessary to determine when a backflow device is needed in the main service line and how many different outlets within the establishment require backflow devices.

The homeowner is not immune!

Probably the most important source of a cross-connection hazard is the individual service line supplying a residence. This seems to be the case because of the homeowners lack of education regarding water systems and potential backflow problems. (Let's face it; if we didn't work in the water supply industry, we probably wouldn't know anything about backflow either.)

Homeowners are known to spray herbicides or pesticides around their lawns and gardens without a proper backflow device at the hose connection. They also like to leave hoses submerged in laundry tubs and animal watering containers without giving it a second thought. Although these actions are done out of convenience with no malice in mind, sometimes the consequences of their actions can cause major problems with the entire water system.

Check it out!

Look around your system and see if you can identify some potential prolems waiting to happen! Check out the front cover of this issue and see if this gives you some ideas.

PREVENTION OF BACKFLOW

There are a couple of ways to eliminate or reduce the potential for a backflow contamination problem.

Eliminate

The first way of course is to eliminate the connection altogether. This is the only option available when the source of contamination is extremely toxic in nature (i.e. - sewage, toxic chemicals used in a manufacturing process, etc.).

Believe it or not, there have been instances where community water systems have installed water service lines into sewer manholes for flushing purposes. Needless to say, this is a totally unacceptable practice! If any of you out there know of such a connection on the old portions of the system, make sure that it is a priority to get this situation remedied.

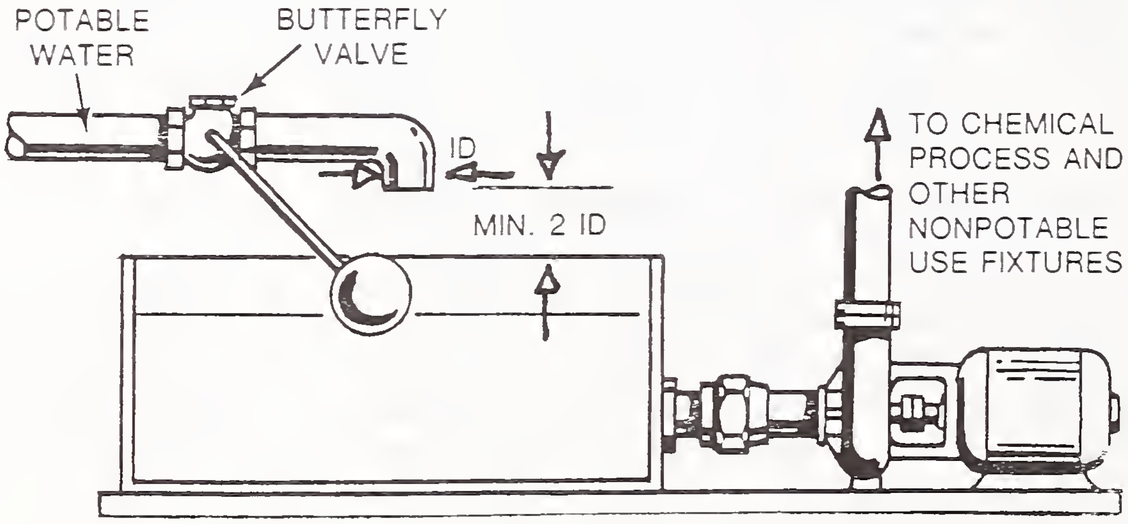
Separate

Another means of preventing backflow is through the creation of an "air-gap separation".

This is a physical separation between the free-flowing end of a potable water supply pipeline and an open or non-pressure receiving vessel (sink, vat, reservoir, etc). This separation must be at least double the diameter of the supply pipe and in no case shall it be less than 1 inch!

An air gap is considered to be the best solution to an existing cross-connection problem. This principle can be applied with success for any type of storage container for mixing chemicals or for any type of piping arrangement that leads into a floor drain. Perhaps you can think of other examples.

Air Gap On Surge-Tank Feeder Line



Protect

For those types of cross-connections that must exist and an air-gap is not feasible, a backflow prevention device is necessary. There are many different brands of devices but there are essentially three main types.

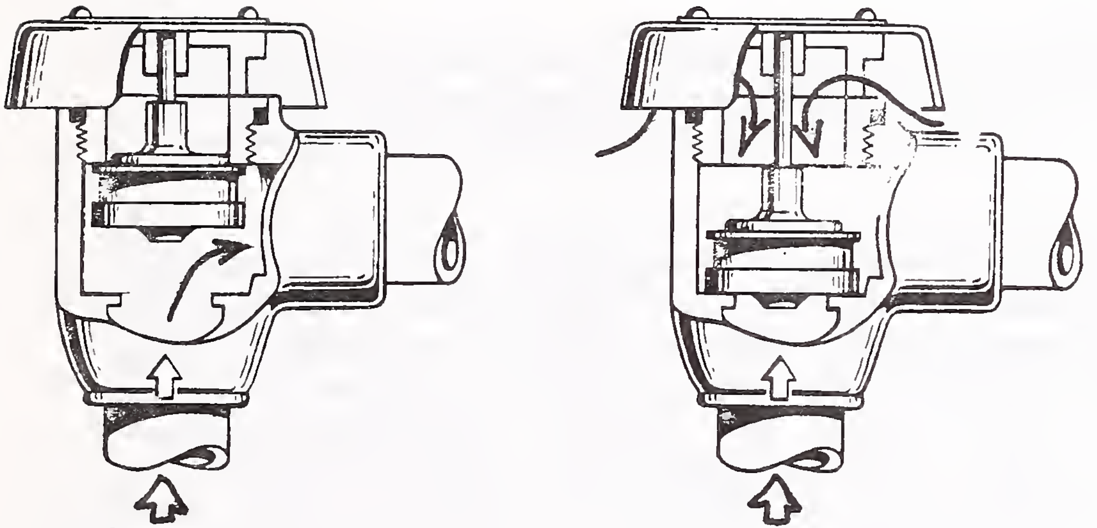
Vacuum breakers

The first type prevents backflow from back-siphonage (usually called a vacuum breaker and it is fairly simple in design. The valve is open whenever there is a flow of water through it but it is drawn back into a closed position when the flow stops and any type of suction action is created.

There are two designs for these valves. One type is designed to work under a constant pressure condition (pressure vacuum breaker and the other isn't (atmospheric vacuum breaker). Check with the product distibutor or call the Water Quality Bureau if you don't know which one is necessary.

A typical application for an atmospheric vacuum breaker is a connection for a garden hose or the end of a yard hydrant. A water hauler's standpipe is also a suitable application.

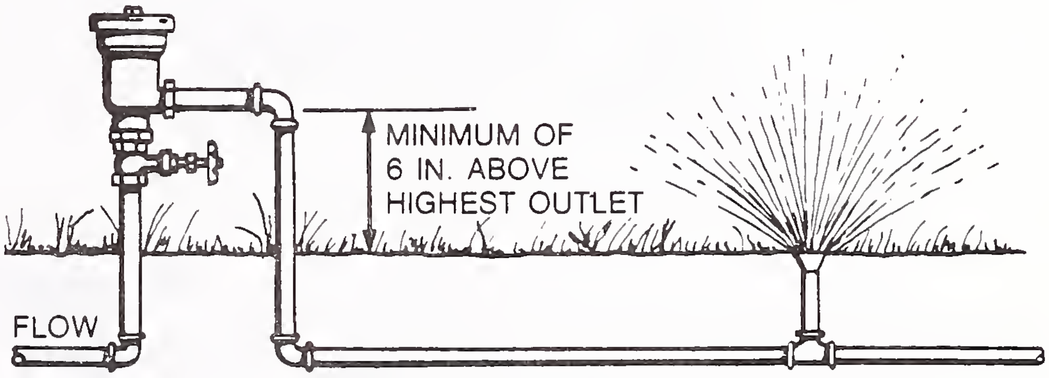
Atmospheric Vacuum Breaker



NORMAL FLOW CONDITION

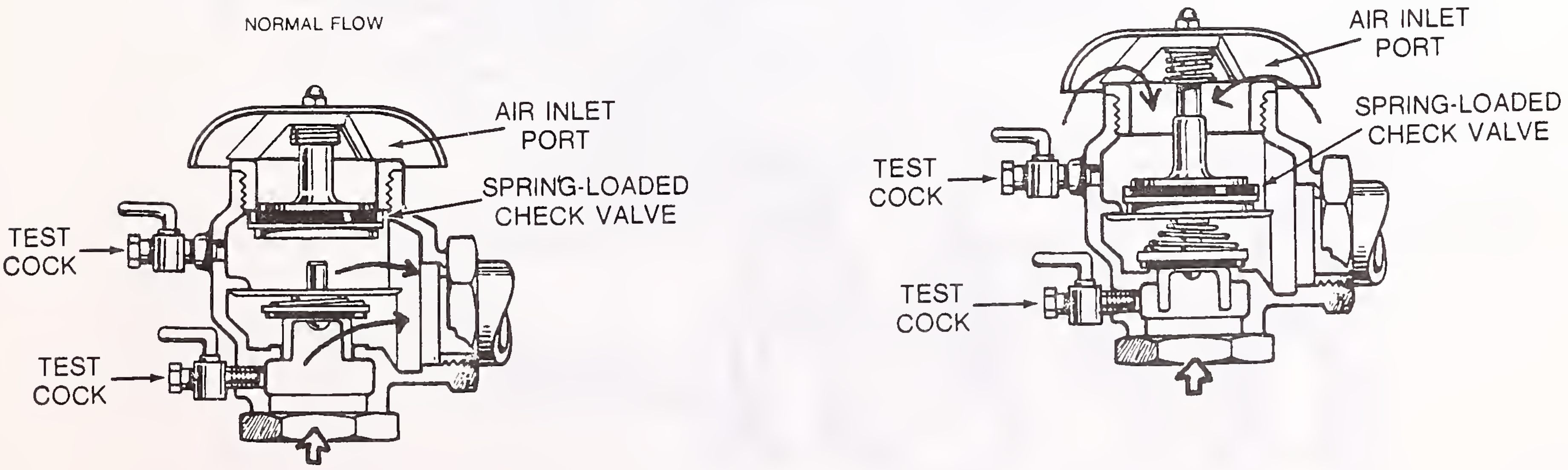
BACKSIPHONAGE CONDITION

Typical Installation of Atmospheric Vacuum Breaker



Absolutely no means to shut off on the discharge side of the vacuum breaker.

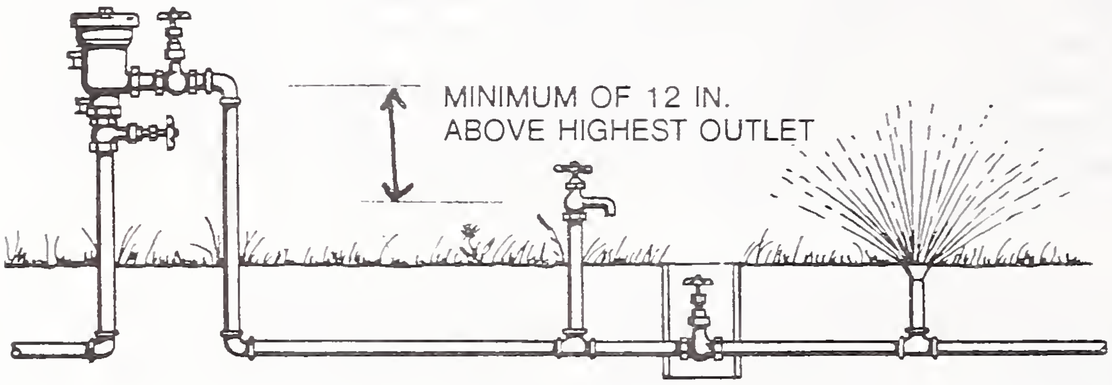
Pressure Vacuum Breaker



NORMAL FLOW

BACKSIPHONAGE

Figure 25 Approved Installation of Pressure Vacuum Breaker



Downstream side of vacuum breaker may be maintained under pressure by a valve but there should be absolutely no possibility of imposing back pressure by pump or other means.

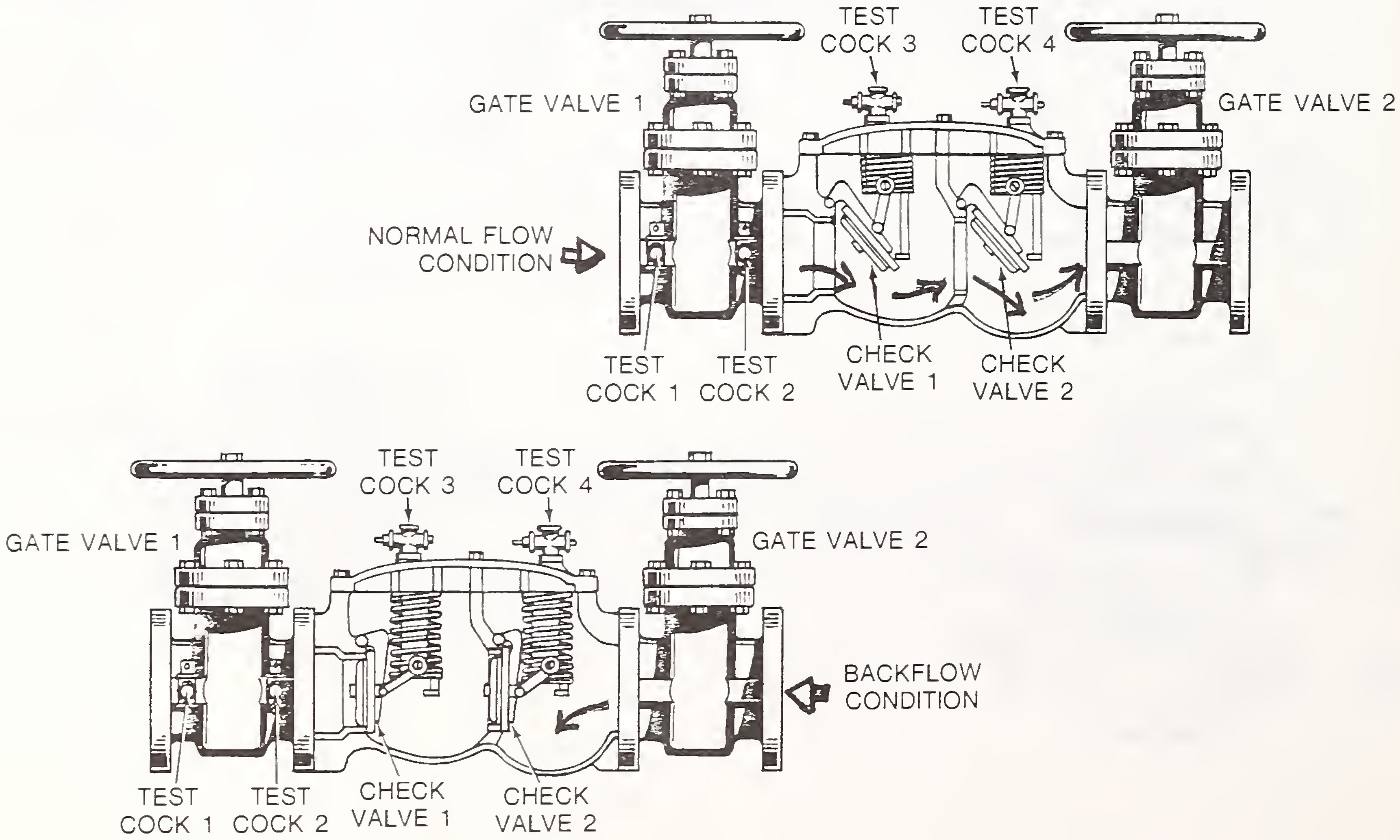
Double check valves

An anti-siphon device is not acceptable whenever there is a danger of backflow from back pressure. This is the case where a boiler system or industrial process must be isolated.

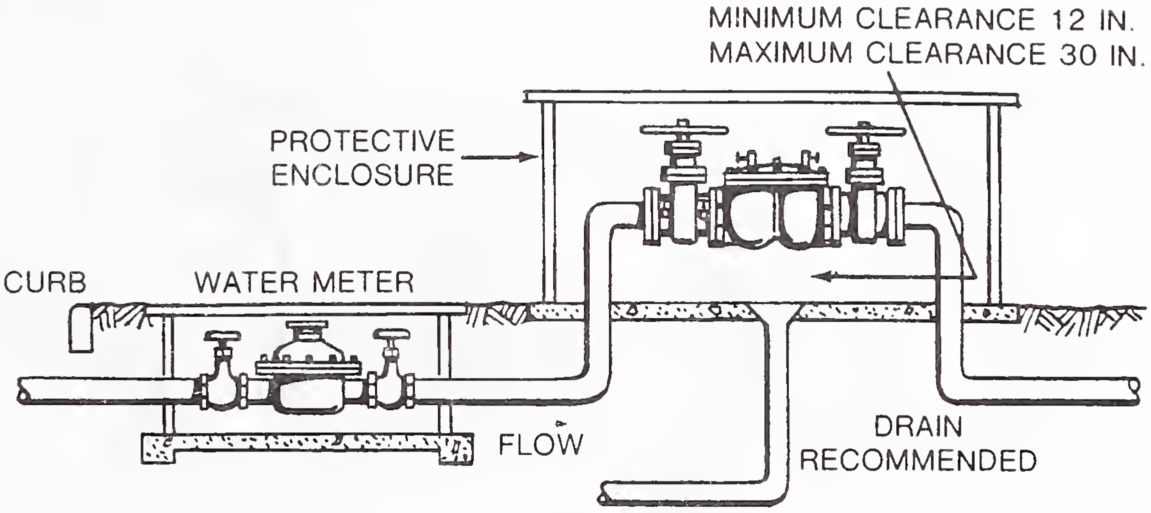
Keep in mind that a pressurized vessel is not the only reason for backpressure backflow. Any outlet that is above the supply pressure at the point of consideration can cause a backpressure problem. For instance, an irrigation system that starts at the well head but goes uphill for a considerable distance will need to have a device at the well to prevent backflow due to backpressure.

To prevent this type of backflow, usually a double check valve assembly is necessary. This device consists of two independently acting check valves which create a double barrier form of protection.

Double Check-Valve Assembly



Approved Installation of Double Check-Valve Assembly



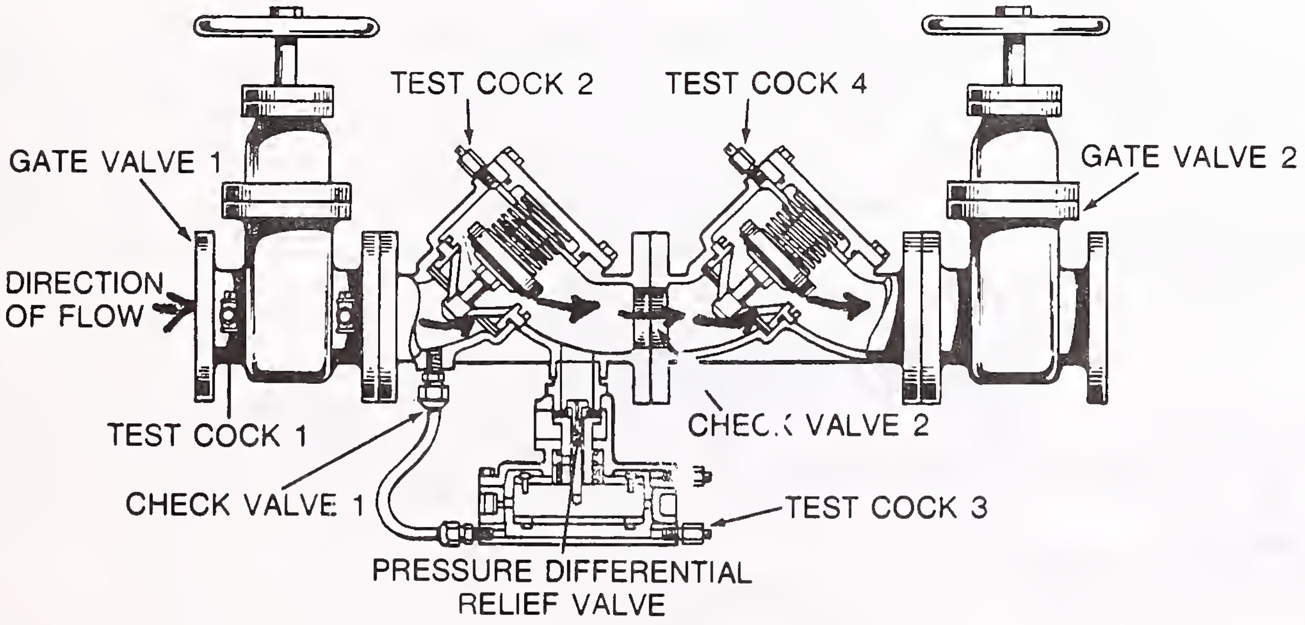
RPZ's

The third type of device and the one used for a high contamination risk situation, is the reduced pressure zone backflow prevention device.

This is quite similar to the double check valve assembly but it contains an extra degree of protection. Between the two check valves in the device is a vent to atmosphere which allows a potential contaminant to drain to waste if the first check valve should fail for whatever reason.

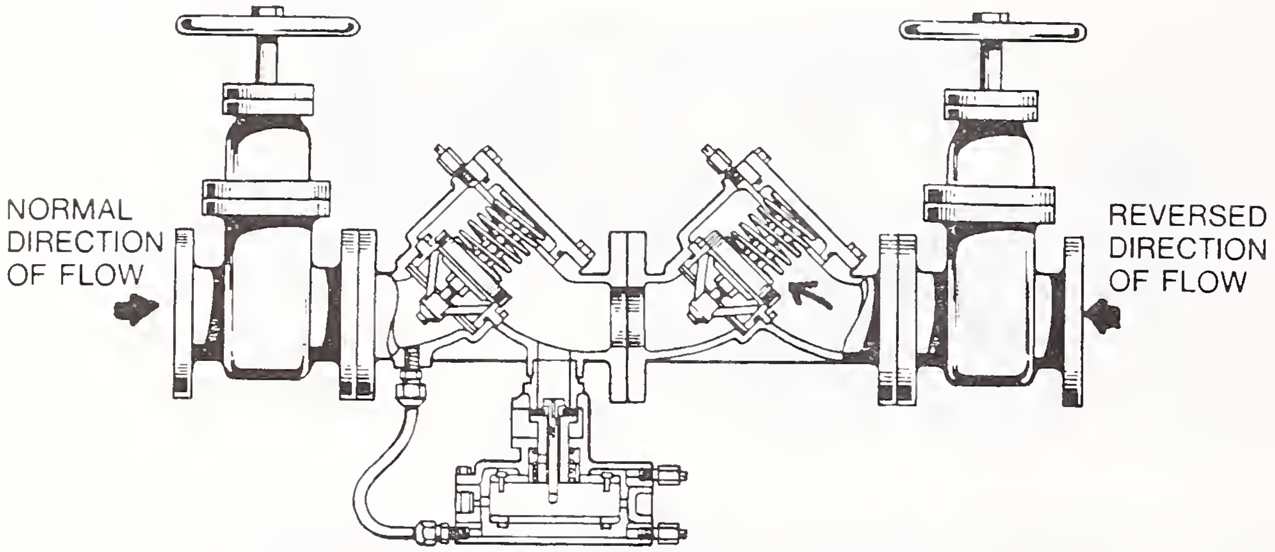
This type of device is necessary whenever there is an extreme health risk with the potential contaminant that might enter the system. It needs to be installed on the service lines to hospitals, laboratories, industrial processes, sewage treatment plants, etc.

Figure 19 Reduced-Pressure-Principle Device—Normal Flow



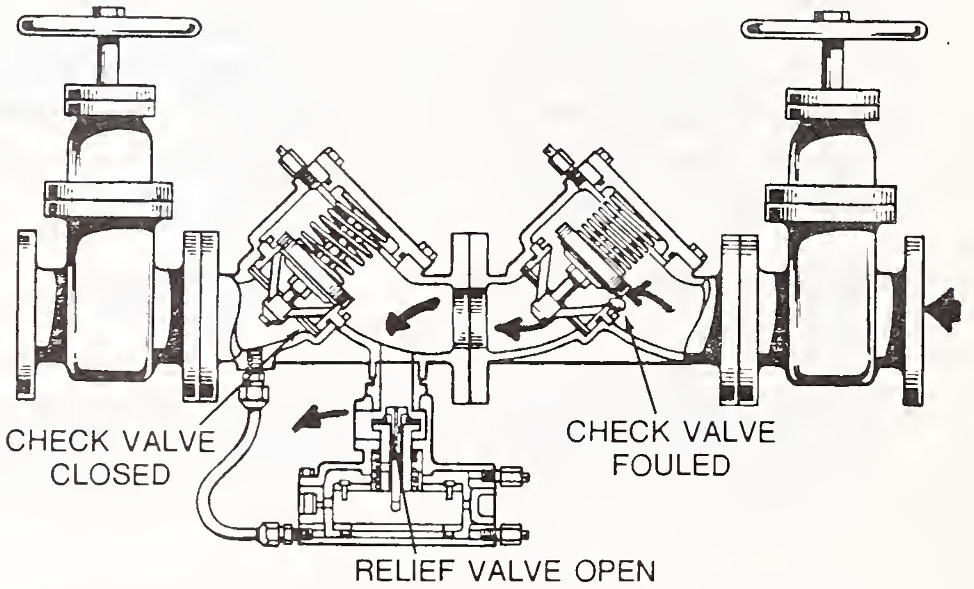
BOTH CHECK VALVES OPEN AND RELIEF VALVE CLOSED

Figure 20A Reduced-Pressure-Principle Device—Reverse Flow



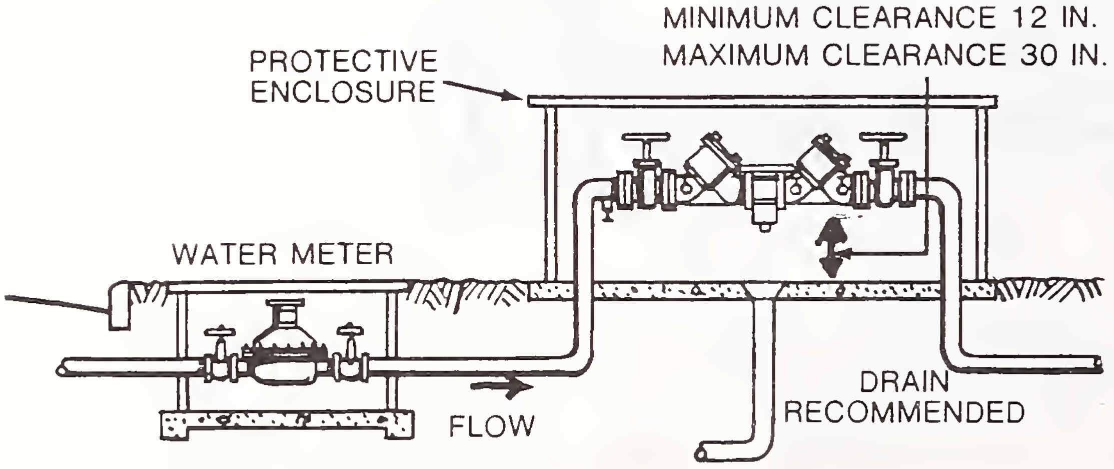
BOTH CHECK VALVES CLOSED AND RELIEF VALVE CLOSED

Figure 20B Reduced-Pressure-Principle Device—Reverse Flow



ONE CHECK VALVE FOULED AND RELIEF VALVE OPEN

Approved Installation of Reduced-Pressure-Principle Device



Protection from homeowner service lines

The type of devices just described provide for the protection from known sources of contamination. You are probably now wondering what is installed on an individual homeowners service line if there were a potential problem or if you just wanted to rest assured that nothing could ever come back into the main portion of the distribution system.

Usually the type of device that is used is a small version of the double check valve assembly mentioned above. It is made to be installed into a 1/2, 3/4 or 1 inch diameter service line and provides the same degree of protection.

One item needs to be remembered during its installation. The installer needs to make sure that the hot water heater in the home is protected by a temperature and pressure relief valve. This is an absolute necessity to prevent a bomb from being created when the heater fails for whatever reason and the water hasn't any place to go due to the backflow device.

Make sure that the temperature and pressure relief valves are installed on all hot water heaters and they are operating properly. (These valves will be the subject of another article which will appear in one of the next two issues.)

DEVELOPMENT OF A CROSS-CONNECTION CONTROL PROGRAM

It has been the purpose of this article to get you suppliers and operators thinking about backflow and the potential problems that can be eliminated.

Perhaps you have already considered the situations described above and have a cross-connection control program that is in operation at the present time. However, if you don't have a program or haven't even considered backflow problems, perhaps you would like to learn more about the problems and how a control program can be initiated.

There are a few excellent sources of information which you can obtain to assist you with your questions. If you would like to get some ideas on what is available, be sure to contact the Water Quality Bureau. We would be more than glad to answer your questions (if possible) or steer you toward someone or some publication that can.

On the subject of developing a cross-connection control program and ordinance for your town, city, or water district; the next issue will address this procedure. This article will be a reprint from a back issue of a national publication appropriately titled "Backflow Prevention".

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Certification Exams Given

ON SATURDAY-------------MARCH 14, 1987-----------------------9:30 A.M.

examinations for certification as a Water Distribution System Operator, Water Treatment Plant Operator and Wastewater Plant Operator will be given at these eight locations:

BILLINGS------in the Yellowstone Room, Student Union Building, Eastern Montana College

GREAT FALLS---in Room S119, Science Amphitheater, College of Great Falls

HAVRE---------in Room 103-4, Math/Science Building, Northern Montana College

HELENA--------in the Conference Room, Helena Fish and Game Building, Sixth Ave/Saunders

KALISPELL-----in Room 35, Montana Hall, Flathead Valley Community College, 15 First St. E.

MILES CITY----in Room 316, Classroom Building, Miles Community College, 2715 Dickinson

MISSOULA------in Room 102, Liberal Arts Building, University of Montana

WOLF POINT----in Study Hall 30, Wolf Point High School, 6th Ave. S./Main Street, N. Entr.

By February 27, as required by ARM, 16.18.204, everyone taking examinations must have:

--completed an application for certification as a water/wastewater operator.
--paid appropriate application (or renewal) fees for fiscal year 87 which ends 6/3/87.
--submitted examination registration slips and fees of $5 per examination.

APPLICATION FEES ARE: Class 1-$27; Class 2-$22; Class 3-$17; Class 4-$12; Class 5-$10.
To request application materials, order study materials, or ask for additional information, call the certification office at 444-2691 or write: DHES-WATER QUALITY BUREAU: Water/Wastewater Operator Certification; Room A206, Cogswell Building, Helena, MT. 59620.

PLEASE RETAIN THE UPPER PORTION OF THIS NOTICE. NO ADDITIONAL NOTICE WILL BE SENT TO YOU.

EXAMINATION REGISTRATION SLIP
(Detach and return with $5 per examination by 2/27/87

I will take the examination(s) I have checked below at: ___Billings ___Great Falls

___Havre ___Helena ___Kalispell ___Miles City ___Missoula ___Wolf Point

	1	2	3	4	5
A--Water Distribution	____	* ____	* ____	* ____	
B--Water Plant	____	____	____	* ____	5AB ____
C--Wastewater Plant	____	____	____	____	

*Combination examinations 2A3B, 3A4B, 4A4B, and 5A5B require $5 exam fee only.

NAME________________ ADDRESS________________ SYSTEM________________

Wastewater Treatment Pond Liners Important?

By: Randy Nelson, Water Quality Bureau

If you operate a wastewater treatment pond (WWTP) system, you probably know exactly how many acres the ponds cover, how deep they are, where all the interpond piping runs, what type of valves are installed, plus dozens of other details and particulars about the system. But do you know whether or not the ponds were constructed with seals or liners, and if they were, what type of liners were installed? Pond seals are usually out of sight, they don't break down with a bang - or with a whimper for that matter - and they don't have much, if any, effect on the quality of the discharge from the system. So it wouldn't be unusual if you weren't familiar with the ponds' lining. And if the liners seem to do so little, you might wonder why were they installed at all?

Well, liners are installed in WWTP's for a simple reason-to keep sewage in the ponds so it exits when it should and where it should. Now that's a real penetrating glimpse of the obvious (PGO). There are several reasons for controlling seepage and some of those reasons are not quite so obvious. First, the majority of WWTP's in Montana are operated as continuously discharging systems, which means they are usually located near surface water and discharge to surface water. Disinfection of the effluent is often required with this type of system, and anything leaking out the bottom isn't being disinfected. Whether or not disinfection is required, leakage will have an adverse effect on the nearby surface water. Second, many WWTP's are located a relatively short distance above aquifers. In those situations sewage leaking from the ponds may end up in someone's KoolAid. Third, seepage can pool on the ground surface down slope and outside the fence of a poorly sealed pond and create a nice place for the neighborhood kids to play - not a nice situation. Fourth, pond seepage has been known to cause excessive soil wetness and salt accumulation (saline seep) in fairly large areas of adjoining farm land. That's all a farmer needs nowadays. And the fifth reason for sealing WWTP's is one that is sometimes overlooked: sewage is best treated in an aquatic environment. In other words, no water, no treatment, big stink.

In Montana, pond seals are designed to limit seepage to 500 gallons per day per acre, or 6 inches per year, from primary ponds and 15 inches per year from secondary or storage ponds. These seepage rates assume a 6 foot liquid depth in the ponds and unsaturated soil beneath the seal. Pond seals or liners can be divided into two groups: soil liners and synthetic membrane liners.

SOIL LINERS

In some parts of Montana, on-site soils have a high clay content and will act as a seal with no more preparation than grading and compaction. In other locations, on-site soils can be modified economically with bentonite and/or chemicals. And in other areas, material to construct a seal can be imported from a nearby clay deposit. Although they use simple concepts and material, both modified on-site soil seals and imported soil seals need careful design and construction to function as intended. Problems with bentonite-modified seals have been caused by basing the bentonite application rate on too few permeability tests of the on-site soil, uneven application rates, or a lack of a protective soil cover. Variations in the permeability of the imported clay material, using a seal thickness of less than 12", spreading the seal in a single layer or lift, or compaction of the seal at something other than the proper water content have caused problems with imported soil seals.

SYNTHETIC MEMBRANE LINERS

When on-site or nearby soils are not suited to the construction of a soil liner, a synthetic membrane liner is used. This type of liner is manufactured from a variety of chemical compounds and may contain a reinforcing fabric. Polyvinyl chloride (PVC), polyethylene (PE), chlorinated polyethylene (CPE), and chlorosulfinated polyethylene (CSPE) are the most common materials used in WWTP liners. PVC and PE are damaged by sunlight (ultra-violet light, to be more specific) so liners made of those materials are covered with about 12" of soil; CPE and CSPE liners are not easily damaged by sunlight and are often left uncovered. Synthetic membrane liners, usually 30 mils in thickness, are delivered to the site in large panels, lapped at the edges and joined with heat or glue to form one single sheet. This sheet is then anchored in a trench running around the top of the dikes. Uncovered liners are usually fitted with sand-filled ballast tubes and vents spaced along the dikes above the water line to prevent wind damage.

Synthetic membrane liners have experienced problems due to using too thin a liner; leaving rocks, roots, or holes in the underlying soil; not sloping the pond bottom to allow venting of gas from beneath the liner; and using an uncovered liner in large ponds which freeze over in winter.

MAINTENANCE

A properly designed and installed liner is a simple part of a WWTP system; it never needs lubrication, adjustment, tuning or realignment. Even so, there are some things that can be done to help it live to a ripe old age. And with new WWTP systems costing hundreds of thousands of dollars for even small communities, and the pond seals representing up to 1/3 the total construction cost, the old saying about an ounce of prevention being worth a pound of cure couldn't be more appropriate. Most maintenance efforts are directed toward the area between the top of the dike and the low water line, and generally consist of little more than careful, periodic inspections, promptly followed up by corrective action when needed.

A WWTP system with a soil liner should be inspected periodically for erosion and deep-rooted plants, the main enemies of a soil liner. Maintaining a good vegetative cover can help control both erosion and weeds. If erosion appears and cannot be controlled by vegetation, adding rip-rap may be necessary. Deep-rooted plants on the dikes or the ponds can penetrate the liner and allow leakage to occur; show them no mercy, exterminate them as soon as they appear. If possible, never let a pond with a soil seal dry out; unless they have a protective soil cover, most clay liners will crack when dried, and some will not reseal completely.

Erosion is also the main enemy of a covered synthetic membrane liner, especially if the liner is made from PVC or PE. Ponds with either of these types of liners should be inspected frequently and thoroughly for erosion. Any exposed liner should be covered immediately and if erosion continues to be a problem, rip-rapping may be necessary.

Some liners used in WWTP's are not very resistant to petroleum products such as gasoline and lubricating oil. During routine daily inspections of the system, the ponds should be checked for the familiar petroleum sheen or smell, and if a petroleum product is finding its way to the ponds, its source should be located and eliminated.

Ponds with uncovered synthetic membrane liners should be inspected often for rips, tears, or seam separations, particularly at or near the waterline. If an uncovered liner develops a leak, the soil in the embankment behind the liner may become saturated. Wave action will then "pump" the water between the liner and the embankment, causing rapid and progressive erosion of the embankment soil, leaving a large cavity behind the liner. So any breaks in the liner should be repaired immediately. If the ponds freeze over in winter, an inspection for rips and tears should be made first thing every spring after the ice has melted. And to be on the safe side, changes in water level should be avoided when ice is present.

Although most uncovered liners are rough and tough, it's still a good idea to keep the gates to the facility closed at all times and keep the fences in good shape so livestock don't have a chance to leave their mark (a puncture mark) on the liner.

Maintenance of a pond liner is simple and takes only a little time. It's time well spent.

P.S. Remember, an uncovered synthetic membrane liner can be very slippery at times down near the water line. Have a helper with a rope handy when working on the dike slopes.

Butte Hosts AWWA Conference

1987 MSAWWA/MWPCA JOINT CONFERENCE AGENDA

Thursday - March 26

7:30	Registration
8:30 - 9:00	Call to order, Invocation, Welcome, Response
9:00 - 9:45	Business Meeting
9:45 - 10:00	Break
10:00 - 11:00	Joint Session "Emergency Planning & Operation Program" (Roundtable) Mike Garrity, Robert Kruse, Jan Henry
11:00 - 11:45	Joint Session "Montana Hazardous Waste Management Plan" Barry Damschen
11:45 - 1:30	Lunch
1:30 - 2:15	Joint Session "Protective Coatings For All Seasons" Dick Polley
2:15 - 3:00	Joint Session "Maintenance to Reduce Liability Exposure" Richard Nisbet
3:00 - 3:30	Break in Equipment Display Area
3:30 - 4:15	Concurrent Sessions Water: "Effects of the Reauthorization of the Safe Drinking Water Act" Dan Fraser Wastewater: "Operator Exposure to AIDS Virus" Bob Hunter
4:15 - 5:00	Concurrent Sessions Water: "Telemetry Control for Storage Tank Level" Eric Campbell Wastewater: "Upgrade & Retrofit of Aeration Facilities for Energy Cost Reduction" Tom Pokorsky
6:00	Final of "Water Taste Test"
7:00	Dinner and Casino Royal

Friday - March 27

8:30 - 9:15	Concurrent Sessions Water: "Steel Tank Maintenance" Ed Knoy Wastewater: "The Great Sludge Disappearing Act" Tom Lowe
9:15 - 10:15	Concurrent Sessions Water: "Chlorine Residual Analysis In Montana Communities" Dr. William Hunt Wastewater: "Lagoon Maintenance" Doris Roberts
10:15 - 10:45	Break in Equipment Display Area
10:45 - 11:30	Concurrent Sessions Water: "Water Meters - Your Investment For Today and the Future" George Klotz Wastewater: "Coordinating Operator Training & WWTP Compliance in Montana" Jan Cranor
11:30 - 1:00	Lunch
1:00 - 2:00	Joint Session "Publicity Programs for Water & Sewer Systems" (Roundtable) John Lawton, Jim Chelini, Kreg Jones
2:00 - 3:00	Joint Session "Implementation of System Development Fees" Joan Ellis
3:00	Business meeting
7:00	Awards Banquet and Dance

SPEAKERS

1987 CONFERENCE

Thursday

Mike Garrity; City of Helena, Helena, MT
Robert Kruse; City of Red Lodge, Red Lodge, MT
Jan Henry; Montana Disaster & Emergency Services Division, Helena, MT
Barry Damschen, Damschen & Associates, Helena, MT
Dick Polly, Polymorphic Polymers, Inc.; Miami Shore, FL
Richard Nisbet; City of Helena, Helena, MT
Dan Fraser; Montana Water Quality Bureau, Helena, MT
Bob Hunter; Brown & Caldwell, Seattle, WA
Eric Campbell; Industrial Technology, Inc., Mineral Wells, TX
Tom Pokorsky, Sanitaire Inc., Milwaukee, WI

Friday

Ed Knoy; Tank Industry Consultants, Speedway. IN
Tom Lowe; General Environmental Science, Beachwood, OH
Dr. William Hunt; Montana State University, Bozeman, MT
Doris Roberts; Northern Montana College, Havre, MT
George Klotz; Badger Meter Company, Scottsdale, AZ
Jan Cranor; City of Billings, Billings, MT
John Lawton; City of Billings, Billings, MT
Jim Chelini; Butte Water Company, Butte, MT
Kreg Jones; D.A. Davidson, Great Falls, MT
Joan Ellis; City of Helena, Helena, MT

MSAWWA AND MWPCA EXHIBITOR

Vendor

The 1987 MSAWWA and MWPCA will be holding their joint annual convention at the Copper King, Butte, Montana, March 25, 26, 27, 1987.

The display booths are an integral part of the convention and you are cordially invited to participate. Display booths are available strictly on a first come first served basis. Each booth will be provided with a draped enclosure and a draped table. The fee for each booth is one hundred and twenty five dollars ($125).

The display area, coffee and rolls will be served Thursday and Friday morning starting at 7 A.M. Coffee and pop will be served during all breaks. The coffee, pop and rolls are supplied by the vendors out of the booth fees.

The booth will open Wednesday from 1 P.M. to 5 P.M. On Thursday they will open from 7 A.M. to 12 noon then again from 2 P.M. to 5 P.M. Friday the booth will open 7 A.M. to 12 noon.

We are also asking for donations from the vendor and their principals so there can be a vendor hosted bar on Thursday nite from 5-7 P.M. Hospitality rooms will be prohibited. If donations permit the bar will be open Thursday night after dinner. All sponsors would get their name printed on a poster which would be hung at the bar. We are asking for a forty ($40) dollar donation or whatever you feel necessary.

Please make checks payable to HOST CITY.

Send to: Bill Pasco
800 Centennial Avenue
Butte, Montana 59701

LADIES PROGRAM

Wednesday - March 25

1:00 - 5:00	Registration - Copper King Inn, Front Lobby

Thursday - March 26

8:00 - 5:00	Registration - Copper King Inn, Front Lobby
9:00	Continental Breakfast, Copper King Parlor
10:00	Graphoanalysis - "Know Yourself Through Handwriting" Linda Young Copper King Inn Parlor
11:45	"Two Decades of Montana Fashions" Arts Chateau Luncheon and Style Show Bus leaves Copper King Inn front entrance
2:15	Bus leaves from Arts Chateau Optional Shopping, Butte Plaza Mall
4:00	Bus leaves Butte Plaza Mall for Copper King Inn
7:00	Get-Acquainted Dinner, Casino Royale

Friday - March 27

9:00	Continental Breakfast, Copper King Parlor
10:30	"How to Make the Game Work for You" Women in the Credit Game Carol Gilmore Copper King Inn Parlor
2:00	Luncheon, Copper King Inn Lounge with conference delegates
2:00 - 4:00	Tour of Greek Serbian Orthodox Church Tour of Israel Binai Synagogue
7:00	Banquet - Awards Copper King Inn
9:00	Dance Copper King Inn Poolside

Who Has Best Water?

Does your city or water district have the best tasting water in Montana? The 1987 AWWA Conference will have an additional highlight this year with a drinking water taste test contest. Bring a sample to the conference and our judges will determine the best of the best.

To enter, bring a one-liter bottle of water from your supply to the registration desk on Thursday morning. There will be a preliminary elimination in the afternoon with the final test that evening.

Good luck and may the best water win!!

ADVANCE REGISTRATION APPLICATION

ANNUAL JOINT CONFERENCE OF MSAWWA AND MWPCA
March 26th & 27th, 1987
Copper King Inn
4655 Harrison Ave.
Butte, Montana
406-494-6666

MAIL TO: BILL PASCO, MSAWWA/MWPCA CONFERENCE, 800 CENTENNIAL AVE., BUTTE, MT 59701

$75.00---General Registration (Members)	$25.00---Ladies Registration
$90.00---General Registration (Non-members)	$40.00---1 Day Registration (Members)
	$50.00---1 Day Registration (Non-members)

*Registrations include ladies tours, two luncheons, Get Acquainted Dinner and Awards - Dinner-Dance Parties.

**A one year membership in either MSAWWA or MWPCA accompanies full non-member registration.

Enclosed please find a check, purchase order, or warrant payable to:

1987 MSAWWA-MWPCA Conference, in the amount of $_______________ .

Name________________________________Title__________________________

Utility, City, Co.____

Address____

City____________________________State______________Zip______________

If Attending: Wife's Name______________________________________

Member AWWA ☐ Member WPCF ☐ Non-member ☐

*Those registering prior to March 1st are eligible for a special prize.

Received from:______________________________Representing________________

For Full Registration______________Other____________Amount: $______________

Bill Pasco-MSAWWA and MWPCA
By:________________________________

(Receipt will be in your packet at the Conference Headquarters)

Aerated Ponds

Viable Wastewater Treatment Option

By: Dick Pederson, Water Quality Bureau

Aerated ponds are becoming more popular in Montana. Operation and maintenance costs are considerably less than required for mechanical plants and less land is necessary than is needed for faculative ponds. These reasons make aerated ponds a viable wastewater treatment option. Currently there are 30 to 40 aerated ponds utilized for municipal wastewater treatment in Montana.

Aerated ponds can be defined as any wastewater lagoon that utilizes a mechanical means to add oxygen to the water. Two methods of providing oxygen to water are: 1) diffused aeration which takes air, compresses it and discharges it below the water surface through diffusers and 2) mechanical aeration which employs machinery to mix air and water allowing oxygen to be absorbed by the water.

The purpose of this article is not only to define aerated ponds but to briefly discuss methods operators have to ensure effective and efficient wastewater treatment.

Operators of aerated ponds have several tools available to them for evaluating the performance of their wastewater system. These include: dissolved oxygen measurements, treatment efficiency, energy usage, and a few of the six senses.

1) Dissolved oxygen is the oxygen that is actually dissolved in water. Most references suggest dissolved oxygen levels should be maintained above 1-2 milligrams per liter in aerated ponds. Dissolved oxygen measurements should be made daily at the same time and in the same location typically from the discharge side of each pond in the system. These values should then be recorded and observed for trends which will give the operator some clues on any needed aeration adjustments.

In the summertime, algae, which are microscopic single-cell plants that live in water, grow in abundance in aerated ponds and are responsible for that green look to the pond water. Like most plants, algae in the presence of sunlight produce oxygen. As a result, elevated dissolved oxygen levels will occur in aerated ponds (typically above 9.0 milligrams per liter) late in the afternoon on sunny summer days. These same algae which produce oxygen in the presence of sunlight utilize oxygen when the sun isn't shining. This will cause dissolved oxygen levels to be extremely low in the early morning hours of summer just before daybreak. In some cases algae are so abundent that operators of some aerated ponds are not able to maintain dissolved oxygen levels above 0.5 milligrams per liter in the morning hours regardless of the level of aeration used. This situation will correct itself as the sun climbs higher in the sky and the algae begin to produce oxygen. In summer months many operators provide aeration only at night to offset the oxygen utilized by algae. During the daylight hours aeration may not be necessary because of the availability of oxygen produced by algae. To monitor this phenomenon summertime dissolved oxygen measurements should be made both early in the morning and late in the afternoon.

Quite a different situation exists in the winter months. As winter approaches temperature drops and algae populations decline. Bacteria that treat the incoming sewage are less active and need less oxygen. Also, at lower temperatures oxygen is more easily dissolved in water. All of these factors lead to the conclusion that less aeration is required in the winter. By keeping track of dissolved oxygen levels the operator can adjust aeration accordingly and show a reduction in energy costs.

2) Treatment efficiency is measured by sampling and analyzing the aerated pond discharge for biochemical oxygen demand (BOD). BOD is a laboratory test which measures the strength of the wastewater. The operator should record BOD values measured from the pond discharge. If the BOD increases to and exceeds the discharge permit limit then the aerated pond is not adequately treating the wastewater and additional aeration may be necessary.

3) Energy usage by aeration equipment should be recorded by aerated pond operators on a monthly basis. Mechanically providing oxygen to water takes energy and energy costs money. By keeping track of energy usage requirements the operators will be able to predict costs to the system. They will also be able to show cost savings made by prudent operational adjustments to the aeration system.

4) The most important tool an operator has is his senses. By observing the aerated pond on a daily basis the operator will detect changes in the system. Poor treatment may cause the pond to change color from a healthy looking green to grey. A foul septic odor is also an indication of poor treatment. The operator should rely on his senses to indicate whether any aeration adjustments to the system are necessary.

By using these four operating tools and realizing the dynamic nature of an aerated pond system the operator should be able to ensure efficient and effective wastewater treatment.

Ingman Wins Rural Water Award

At the seventh annual Montana Rural Water Systems Annual Get-together, Denise (Osterman) Ingman was the recipient of the Montana Rural Water systems Board of Directors Certificate of Recognition. This award is presented to individuals not directly connected with the Rural Water Program but who have had an active part in it.

Since the beginning of her employment as Water and Waste Water Training Instructor with the Water Quality Bureau, Denise has played an active role in the Montana Rural Water Program by participating in most of the Rural Water Workshops bringing information about the Federal Safe Drinking Water Act and other State and Federal regulations effecting water systems. She has also served as a valuable source of information and assistance to rural water systems during the past seven years.

We congratulate Denise for her award and praise her for the extra effort she has put forth to help water operators through her regular activities and her efforts in the Montana Rural Water Program.

Major Events in MWPCA

By: Joe Steiner
Water and Wastewater
Superintendent, Billings

In keeping with my promise to keep the association informed of the events of the Federation, I offer the following summary of the major events since last May.

The major event of the Federation was the conference in Los Angeles in October. During the Board of Control meetings, numerous business transactions took place. Two actions stood out that I feel should be shared with you.

After 29 years of service to the Federation, Robert Canham stepped down as the Executive Director. A search committee received over 400 expressions of interest and 100 final applications for the position. The exhausting selection process resulted in the recommendation of Dr. Quincalee Brown as the new Executive Director and the selection committee made said recommendation to the Board of Control. After considerable debate over the primary requirements of the Executive Director, the Board of Control agreed that strong management skills are essential for the manager of WPCF. The Federation has a $6.0 million budget, massive data management needs and 32,000 members. This requires an efficient and experienced manager. Dr. Brown best met those requirements and was approved by the Board of Control.

The 1987 budget received a high degree of attention. Considerable debate centered around the proposed increase in dues beginning January 1, 1987. My attitude toward the dues increase was one of opposition for the following reasons. Campaign '86 was successful in increasing the Federation membership through numerous promotional activities and to follow those activities with a dues increase was untimely. Also, the increased revenue resulting from the dues increase is quite minimal compared to the Federation's overall budget. However, after a close rollcall vote, the Board of Control approved the proposed 1987 budget inclusive of the dues increase. The dues, established in 1982, shall be increased as follows: $5 a year for active members, $2.50 for Operations Division members and various percentage increases in all other categories of membership.

Numerous other actions were discussed at the Board of Control meeting including membership growth, the federation's move to the new building, new Federation publications, and the approval of the WPCF planning document, "A Strategy for Tomorrow 1986-87." A more detailed report on the happenings at the Los Angeles conference can be found in the December issue of the Journal. Also, a report will be given at the annual MSAWWA/MWPCA Conference in Butte.

Operators Pass Exams

CLASS 1:
*Herbert Bartle, Belgrade, 1B-ot
Gail Beatty, Whitehall, 1B-ot
Larry Bullard, East Glacier, 1B-ot
Eric Campbell, Bozeman, 1B
Mike Certalic, Bozeman, 1A
*Jan Cranor, Billings, 1A-ot; 1B-ot
*Les Deines, Laurel, 1C-ot
*Mathew Egan, Colstrip, 1A-ot
*Andrew Finnicum, Culbertson, 1A-ot
*Cindy Fuhrmann, Great Falls, 1B
*John Gilsdorf, Hardin, 1B-ot
Charlene Knaack, Bozeman, 1C
*Gary Mannix, Butte, 1C-ot
*George Schneider, Laurel, 1B
Michael Wade, Miles City, 1B-ot
*Ronald Watson, Fort Benton, 1B

CLASS 2:
Steve Briggs, Livingston, 2C-ot
Douglas Daniels, Belgrade, 2A3B
Michael Davis, Whitefish, 2C
*Robert Doney, Kevin, 2A3B-ot
*Mathew Egan, Colstrip, 2A
Richard Koehn, Billings, 2A
Jered Kuno, Livingston, 2C
*Daniel Hembd, Kalispell, 2B
Catherine Holzworth, Lewistown, 2C-ot
*Lyle Rich, Babb, 2A
Bud Van Smith, Belgrade, 2A3B-ot
Robert J. Smollack, Columbia Falls, 2C
Sidney L. Walker, Highwood, 2C

CLASS 3:
*Roy Buechler, Joliet, 3C
Douglas Daniels, Belgrade, 3C
Patrick Dennis, Ashland, 3A4B
*Robert Doney, Kevin, 3C
Leland Leivo, Bigfork, 3A-ot
Robert Morris, Lincoln, 3C
Harry Ridgway, Bozeman, 3A4B, 3C
*Mark Schmidt, Whitefish, 3C
Kevin Whittenburg, Thompson Falls, 3C
Ord A. Wilbur, Ashland, 3A4B
Mark Wilson, Missoula, 3C

CLASS 4:
William Davis, Columbia Falls, 4AB
Earnest Evenhus, Sand Coulee, 4AB
Roger Guptill, Sunburst, 4AB-ot, 4C-ot
Chuck Jorgenson, Billings, 4C-ot
*Kevin Kennedy, Bozeman, 4C
*Norman Larsen, Moore, 4C
*Mike Loomis, Miles City, 4C
Sam Novich, Twin Bridges, 4AB, 4C
Spencer Simanton, Zortman, 4AB

CLASS 5:
Robert Allen, Bozeman, 5AB
Robert G. Grinsteiner, Hardin, 5AB
Patrick Hensleigh, Bozeman, 5AB
Brion Michaelis, Bozeman, 5AB

WPCA Active

By: Kristi Kline
Montana WPCA President

The Montana WPCA has been very active this fall. Here is a summary of all the activities.

We have 30 Professional Wastewater Operators Division (PWOD) members as of November 30, 1986, which entitles the Montana WPCA to have a PWOD Zone Representative. Mike Garrity, Superintendent of the Helena Wastewater Treatment Plant, has accepted the three year term. Mike will be working closely with our Zone Director Graeme Faris from the British Columbia WPCA about upcoming information and activities for PWOD. If anyone has questions about PWOD or would like to join, contact Mike at: City of Helena Wastewater Treatment Plant, 708 Custer Avenue, Helena, MT 59623, 442-9920 ext. 456.

The membership campaign for 1986 is over and Montana came in second for our region. We were only one percent behind the British Columbia WPCA. We anticipate our 1987 membership campaign to do well also. To join, contact Dick Pederson or Diane Davison at the WQB, 444-2406; Mike Garrity at 442-9920 ext. 456; Rod James at Montana Tech or any WPCA or PWOD member.

Montana WPCA received a Safety Certificate of Merit for our WPCA committee activities for 1986 that included anything pertaining to safety (seminars, safety contests, etc.). Safety is an important policy in water treatment and wastewater treatment and we need to continue to keep our safety awareness at a high level. If you have any suggestions for safety awareness, contact Dave Brown, chairman of the Joint Safety Committee at 761-7004.

We've Won A Battle But Not the War

Flathead Phosphorus Campaign

By: Scott Anderson, Water Quality Bureau

The recent implementation of a phosphorus detergent ban in Flathead County represents a major step in reducing accelerated eutrophication in Flathead Lake. With the majority of development adjacent to the lake residing in unsewered communities, the detergent ban may be the only practical means of controlling phosphorus from existing sources. All new subdivisions located within 1/2 mile of the lake or contributing streams must satisfy state standards which require soil disposal systems to be capable of removing all phosphorus by adsorption to the soil particles. County adoption of the state standards is being proposed to control those sources regulated by county authorities.

Progress is also being made in controlling phosphorus from municipal discharges. Construction will begin in February for a new wastewater plant in Bigfork which removes phosphorus by chemical addition and filtration. Columbia Falls is in final design stage with bid letting planned for early this spring. Whitefish will begin construction this summer on a phosphorus removal facility. Plans are in the mill for a flocculating clarifier with a belt filter press for solids handling to follow the existing aerated lagoons in Whitefish. The city of Kalispell is comparing biological phosphorus removal with the alum chemical precipitation process. As a result of a stringent discharge limit to Ashley Creek, piping the treated effluent to the Flathead River is being considered for Kalispell.

Unsewered communities within the Flathead drainage basin are looking at centralized sewage collection systems to eliminate public health hazards and ground water contamination. A sewer connecting the Woodland Park area to the Kalispell treatment system is now under construction. Bids will be let in February for a centralized sewer system for the Lakeside area. This system will collect wastewater from a large service area, pump northward towards a treatment site above Somers and spray irrigate the treated effluent. Facilities planning is underway to consider connection of Somers and adjacent areas to the new Lakeside system. Evergreen and areas surrounding Whitefish Lake are in the planning process with centralized sewage collection systems proposed. Public issues related to annexation, development, costs, and need have stymied both of these projects.

Although degradation of Flathead Lake has been a major issue for many years we are finally beginning to reap the benefits of the efforts made to reduce man-caused phosphorus discharges into the lake. With the completion of much of the construction initiated this summer in the next one or two years a major reduction in phosphorus loading will be realized. The people from the Flathead area working on these projects and the rate-payers who ultimately pay the extra costs should be congratulated!

Nocardia Experiences

By: Gary Root
Treatment Plant Operator
Columbia Falls

EDITOR'S NOTE: Most operators of mechanical plants experience Nocardia foaming problems. Gary Root, who operates the Columbia Falls wastewater treatment plant, is one of those operators. Gary's experience in dealing with Nocardia prompted the following article.

What is Nocardia?

Nocardia is a filamentous aerobic bacteria, which seems to grown best in environments with a meager food supply and a pH of near 7. It usually manifests itself as a brown, viscous foam. It is hypothesized that during cell growth a hydrophobic (water resistant) substance is deposited outside the cell wall. Thus in an aerated environment, air bubbles attach to the filamentous structure decreasing the density of the floc to less than water, causing it to float as foam on the water surface.

Not much is known about how and why Nocardia grows where it does and many conflicting reports exist. In my experience, Nocardia is principally found in environments which have a dilute supply of the chemicals it metabolizes for food. The Columbia Falls Wastewater Treatment Plant (WWTP) is one such place where Nocardia grows well. It is a completely mixed extended aeration facility operating at a food to microorganism (F:M) ratio of .10 or less. The aerobic digester, another biological unit process at Columbia Falls, also operates at a low F:M. The aerated sludge lagoon at the end of the process stream is another dilute food environment for the culture of Nocardia. In addition, most of the influent has to pass through lift station wet wells that have a finite detention time. This allows some of the food to be consumed by microorganisms in the lift stations resulting in an even weaker influent strength. This is especially noticeable during the warmer summer months. The plant is also under-loaded for its size due to room for future population growth built into the size of the aeration basin. This in effect establishes a limit of how little microbiological solids must be maintained for good settling of the activated sludge.

The hypothesized reason why Nocardia thrive in a low F:M environment is because it exists as a filament. The filament has a greater surface area than other bacteria, and therefore there is a greater opportunity for a food molecule to cross its cell membrane. It has a competitive advantage in a dilute environment. For this reason, Nocardia is not often found in a plug flow system, because the dilute food environment exists only at the end of the flow stream.

Nocardia Problems

At the Columbia Falls WWTP micro-environments located after the completely mixed aeration basin provide places for the accumulation of Nocardia. The areas behind the submerged wier at the aeration basin outlet, the flow control box and the clarifier influent well all can become plugged due to a buildup of the viscous brown foam. The foam becomes trapped in these areas and unless physically removed, the dilute food supply allows Nocardia to establish itself.

Some Nocardia is not undesirable since it provides the filaments necessary to form the backbone of a well settling floc and an excellent effluent. The problems come when Nocardia becomes predominant in the mixed liquor and causes bulking or becomes established in the micro-environments and blocks flow. In a severe infestation the whole surface of an aeration basin can be covered, spilling over onto catwalks causing safety and nuisance conditions. The foam on outdoor channels and clarifiers can freeze, blocking flow or stopping clarifier scum arms from functioning. Although no cases of illness have been reported, Nocardia has been reported to be an opportunistic pathogen so proper hygiene should be practiced. When Nocardia becomes predominate, slow settling of the activated sludge and bulking can occur.

Another indication of the presence of Nocardia is the presence of floating clumps of sludge, or pancakes, on the surface of the secondary clarifier. The pancakes float to the surface and breakup, adding TSS to the effluent. This is usually only a minor problem because the effluent is usually very good.

Nocardia can also cause problems in aerobic digesters. Aerobic digestors are a depository for the waste activated sludge stream seeded with Nocardia. The only food available is that of the cells themselves. Aerobic digesters are usually warmer than aeration basins and have a pH of 7 making this an ideal environment for the growth of Nocardia. If close attention is not paid to the digester level and the amount of air supplied, the inevitable layer of foam can expand out the top of the digester covering everything in sight with a chocolate foam. Turning the air off to the digester and allowing the digester or sludge storage lagoon to go anaerobic controls the foam, but decanting the supernatant back to the aeration basin will just reseed the basin with dormant Nocardia.

Control of Nocardia

Massive wasting must be used to solve the problem of severe Nocardia infestation. If it is not done the system will correct itself through massive self wasting into the effluent. In less severe cases of Nocardia infestation, where bulking is not occurring but the surface of the aeration basin is covered by foam, the classical answer is still to increase wasting, but caution must be used. Any sludge wasted after the floating layer disappears is not going to effect the Nocardia population and too much sludge can be wasted adversely effecting the sludge settling and effluent quality.

Nocardia can be observed as a floating layer in a centrifuge spin test of the waste activated sludge. A spin test may indicate the absence of Nocardia in the waste activated sludge stream, although basin surfaces are covered with the foam. The foam must be physically broken up and resuspended into the mixed liquor if it is going to pass through a submerged wier, and be wasted. Constant repetition of a water stream from a fire hose can reduce the foam somewhat. Spray bars in the micro-environments where the Nocardia collects can be partially effective. Of course, this is effective only when the temperature is above freezing. Recently we have taken to closing the shear gate in the flow control box, allowing the level in the aeration basin to rise above the submerged wier and then opening the gate. The hydraulic surface clears out the flow control box and the Nocardia floats over the wier removing it from the aeration basin. This usually plugs the scum pit beach which then must be cleaned.

A selector has been reported to be effective in controlling Nocardia. A selector is a small tank located before the aeration basin, in which the concentrated influent is mixed with the return activated sludge. Since the food is more concentrated here than in the aeration basin, Nocardia has less of a competitive advantage over more desirable microorganisms and therefore it is gradually eliminated. It seems to me that in smaller plants returning the RAS to the head of an aerated grit chamber instead of the outlet might work.

It has also been reported that a pH of less than 7 will reduce Nocardia growth. If true, it would seem reasonable to have alum, which reduces pH by destroying alkalinity, added to the aeration basin in a tertiary phosphorus removal plant, rather than as a tertiary add on. At a pH of 6, phosphorus precipitation would still occur efficiently, and Nocardia should be further inhibited.

Operators must remember that the foam on an aeration basin can contain a substantial amount of solids. A measurement of the aeration basin mixed liquor for volatile suspended solids to calculate the F:M can result in a higher value than actually occurs because these solids are missed in the analysis.

Past Experience

Package plants have often been sold by touting the lack of required maintenance and operational manpower because supposedly the waste is completely converted to cell mass and the cells go into an endogenous respiration mode and convert themselves to carbon dioxide and water. These plants often go years without any attention, usually until something plugs up. When inspected the plant will often be a mass of brown foam. The reason is so much cell mass has accumulated relative to the influent food therefore a perfect environment for Nocardia growth was created.

The first Columbia Falls WWTP was an EPA innovative and alternative design and not unlike a package plant. The plant consisted of a completely mixed aeration basin with two square clarifiers built inside the aeration basin and filled with settling tubes like those found inside water treatment plant final settlers. Inside the clarifier was another structure housing sand filters. This design was a dismal failure for a number of reasons. One was that inadequate provision for wasting was provided because the plant was supposed to run with little sludge production because it was an extended aeration plant. Further, the interior of the settling tubes created thousands of low F:M micro-environments ideal for the growth of Nocardia. The tubes eventually became clogged, sometimes floating the settling tube apparatus, and creating hydraulic problems because the flow had no way to escape the plant. The sand filters were quickly removed to help the hydraulic problems but the settling tube remained an insolvable problem. The cycle of gradual buildup of sludge caused by inadequate wasting and plugging tubes caused bulking, leading to the eventual washout of the whole microbiological population. This cycle was repeated monthly, year after year and caused many operators to find employment elsewhere because they were being blamed for the problem. Occasionally the TSS in the effluent was 600 mg/l, or three times the influent concentration. The only time the plant gave satisfactory treatment was during the night when the flow was 400% less than average. Under this low flow condition the Nocardia formed an excellent filter with its many filaments straining the water. But every morning the hydraulic surface raised the effluent TSS to an average of 100 mg/l.

Summary

In summary, Nocardia can be a major problem in an extended aeration plant with inadequate sludge handling facilities. It can be a nuisance in micro-environments favorable for this growth, and since not enough is known about how to control it biologically, continuous physical methods must be used to keep it to only nuisance levels.

Food for Thought

It used to be that all kinds of esoteric articles could be obtained through Interlibrary Loan, and especially if you worked for the City. In the smaller towns the librarians were always "wowed" if you wanted an article on actinomyctes or whatever and they could and would get the article for cheap or for free. With all the State budget cuts, it is harder. Contact the WQB for guidance on how to obtain articles. The following are offered as sources for further reading.

Sezgin, M, Kan, P., "Control of actinomycte scum on aeration basins and clarifiers," JWPCF 58, 972 (1986).

Eikelboom, D.H., "Filamentous organisms in activated sludge." Water Res. 9 365 (1975)

Strom, P.F. and Jenkins, D., "Identification and significance of filamentous microorganisms in activated sludge." Proc. Res. Symp. 5th Annual Conf. WPCF (1981)

Eikelboom, D.H., "Identification of filamentous organisms in bulking activated sludge." Prog. Water Technol. 8 (6) 153 (1977).

Jenkins, D., "The control of activated sludge bulking." Presented at the 52nd Annual Conference, California Water Pollution Control Federation, Monterey, California, May, 1980.

Seagin, J., Jenkins, D., and Parker, D.S., "A unified theory of filamentous activated sludge bulking." JWPCF 50 362-380 (19878).

Cranor, Pederson and Hegg Present Paper

A paper entitled "Coordinating Operator Training and Wastewater Treatment Plan Compliance" was presented at the Water Pollution Control Federal meeting last October in Los Angeles, California. Jan Cranor, Assistant Superintendent, Water Treatment Plant, Billings, presented the paper which was co-authored by Dick Pedersen, Water Quality Bureau, and Bob Hegg, Process Applications, Inc., Fort Collins, Colorado.

The paper discusses a program implemented in Montana to achieve improved performance at wastewater treatment plants through on-site, over-the-shoulder training. It also discusses a state strategy for training and compliance involving various training entities and state programs. The paper is available from Dick Pedersen at the Water Quality Bureau and will be presented at the Montana AWWA-WPCA meeting in March.

1987 Training Calendar

Following is a list of 1987 training events for water and wastewater operators. The sponsors of each seminar will send specific agendas approximately 2 to 4 weeks in advance to operators in the surrounding area or to everyone when a seminar is offered in one location only. Additional seminars may be scheduled and advertised in addition. If you need information prior to receiving a specific agenda, call Denise Ingman or Dick Pedersen at the Water Quality Bureau in Helena at 444-2406.

DATE	TOPIC & APPROX. COST	LOCATION	ESTIMATED CEC'S
Jan. 8, 1987	Class 5 Certification Review & Exam	Helena	.2
Jan. 13, 14,	Math Review Wells/Lagoons	Missoula	.8
Feb. 3, 4,	Math Review Wells/Lagoons	Glasgow	.8
Feb. 18, 19,	Math Review Wells/Lagoons	Kalispell	.8
Mar. 3, 4,	Math Review Wells/Lagoons	Billings	.8
March 14,	Certification Exam	Billings, Great Falls, Havre, Helena, Kalispell, Miles City, Missoula, Wolf Point	
March 25, 26, 27,	AWWA/WPCF Annual Conference $75	Butte	1.0
April 16,	Rate Structuring	Shelby	.5
April 21,	Water Distribution $10	Livingston	.5
April 23,	Water Distribution $10	Wolf Point	.5
April 30-May 1,	Water Tank Design, Maintenance & Repair $50	Helena	1.0
May 7,	Rate Structuring & Well Maintenance	Lewistown	.5
May 12, 13, 14	Wastewater Laboratory Methods & Quality Assurance $50	Helena	1.8
May 20	Emergency Planning & Recordkeeping	Billings	.5

June 4,	Chlorination	Great Falls	.5
June 9,	Disinfection	West Glacier Park	.5
June 11,	Rate Structuring & Recordkeeping	Kalispell	.5
June 18,	Chlorination	Missoula	.5
July 16,	Chlorination	Glendive	.5
Aug. 6,	Chlorination	Billings	.5
Aug. 12,	Leak Detection & Recordkeeping	Twin Bridges	.5
Sept. 1	Chlorination	Wolf Point	.5
Sept. 3	Chlorination	Crow Agency	.5
Sept. 14-18,	Annual Operators School and Certification Exam $50	Bozeman	2.5
Oct. 8-9,	Montana Rural Water Annual Conference $35	Great Falls	.75
Oct. 18-24,	National Rural Water Annual Conference	Charleston, S.C.	1.0
Oct. 22,	Pump Seals & Packings & Alignment	Kalispell	.5
Nov. 5,	Pump Seals & Packings & Alignment	Helena	.5
Dec. 3,	Basic Topics for Small Water Systems	Thompson Falls	.5

* * *

The 1987 Training Calendar was mailed to certified operators in early January. Hopefully it will be of assistance in scheduling attendance at continuing education seminars for both personnel new to the field of water and wastewater and to those certified operators trying to fulfill continuing education credits for certification renewal.

Five seminars were scheduled on Math Review and Wells and Lagoons. The four already held in Great Falls, Missoula, Glasgow and Kalispell were very well attended. The last seminar of this series will be held March 3 & 4 in Billings. Specific agendas were mailed in early February; however, if you wish to attend and haven't received an agenda, contact Denise Ingman at 444-2406 today.

In April, the Water Quality Bureau and the Joint Education Committee will co-sponsor two Water Distribution seminars in Livingston and Wolf Point. Topics to be addressed include valve and hydrant installation and Operation and Maintenance, pipe selection and state requirements regarding the construction of water and wastewater facilities.

Be sure to make plans to attend the two-day Water Tank Design - Maintenance and Repair seminar on April 30 and May 1 in Helena. Mr. E. Crone Knoy, president of Tank Industry Consultants, Speedway, Indiana will teach this course.

On May 12,13 and 14 Northern Montana College and the Water Quality Bureau will present a Wastewater Laboratory Methods and Quality Assurance seminar. This will be a limited enrollment class specifically designed for wastewater treatment plant operators doing their own compliance monitoring.

During the summer of 1987 there will be several hands-on chlorination seminars offered by the Water Quality Bureau at various locations throughout the state. In the fall, following the Annual Operators School in Bozeman, two seminars on Pump Seals, Packing and Alignment will be offered.

Other seminars listed on the 1987 calendar are being sponsored by Montana Rural Water.

If you have seminar topic requests for the remainder of 1987 or 1988, or if you would like to sponsor a seminar, please contact Denise Ingman at the Water Quality Bureau, 444-2406.

So You Want to Upgrade Your System

By: Tom Barr
Gore Hill Water District

Thinking about upgrading your system? Let me wish you luck! You are going to need all you can get. Even a minor modification is expensive and demands a high degree of personal involvement by a few people.

Basically there are three stages for any upgrading program. These stages are planning, construction and financing, and all three are interrelated.

Finance is the area which makes or breaks all of us. Obviously, a district's ability to finance a project dictates its ability to complete the project. No two districts, even of approximately the same size and resources, command the same borrowing ability. What turned out to be the only source of financing for my district, may be unacceptable to yours.

More about finance later; let's take a look at planning. This is where the game gets interesting.

Planning

Try to get an individual wish list of system modifications and improvements from everyone involved with the system. Consolidate the individual lists into one primary list and prioritize each item. Be careful not to throw an item out just because it seems to lack merit. Keep it on the list for it may begin to show merit at some future date. Update your list every 2-3 years as changing conditions cause priorities to change.

Once you have the priority list established, fit it to a time frame. This will give you a reference or index of the urgency of accomplishing these modifications. Some may be time sensitive or urgent while others may safely be postponed. One thought to keep in mind--don't propose a modification now that will be deleted in subsequent modifications!

Rough design the basic project. Don't go into great detail at this stage as this exercise is to determine basic parameters and not final design/construction specifications. The design must include all aspects of the project: concrete, carpentry, electrical wiring, etc. The design detail varies according to the size of the project. A three foot square by 2-1/2 inches deep concrete pad requires considerably less detail than a new 24 foot square pump house.

With your schedule laid out and the basic design parameters outlined, you can now begin detailed planning. This is when the Montana Rural Water Association (MRWA) and the Water Quality Bureau (WQB) should be consulted. If the magnitude of the project is sufficient to require WQB engineering approval, they will let you know. This means that a licensed engineer must submit formal plans for approval. Neither the MRWA or WQB can do the engineering for you. However, both have considerable experience and expertise they will share with you.

Construction

Decide if you are going to do all or part of the project yourself. Bear in mind that do-it-yourself projects tend to take much longer to complete as manpower availability is a prime consideration. However, it's surprising how much a board of directors can accomplish working just two or three weekends a year. You may have to knock on doors until you have the additional manpower needed. This won't work if you need them 8 hours a day for three days, but if you need five or six days for 30 minutes, give it a try. The secret to success with a do-it-yourself project is preplanning. Don't get ready to work and blow the whole project by having to make repeated trips to town for facts, materials or supplies.

A number of our upgrades have been accomplished through a combination of contractor and self-help. That is, we have hired a contractor to do that portion of the modification beyond our capability, then completed the job ourselves.

The simplest way to complete a project is to hire a contractor. It is also the most expensive. We have limited our do-it- yourself activities to areas well within our capabilities. 110 volt wiring for lights, etc., we can handle, but 440 volt, three phase pump motor wiring and controls, we think is best left to a professional.

Checkout and operation is the final portion of the construction phase. When any new equipment is installed, make sure you get the owner's manuals and operating instructions. The contractor will demonstrate proper operation of any equipment he has installed. However, you and your operator are responsible for day to day operation and your contractor can't fine tune the system to meet your daily requirements. Operating or procedural changes caused by the introduction of new equipment must be implemented. Don't get impatient. Sometimes it takes months to get operating procedures sorted out for optimum operation. Make sure you file those operating manuals where they will be usable the next time you need them.

Financing

Most water systems can pay cash for a small project. Things get a little trickier for a moderate to a large project as you have to start looking at ways to finance construction. My district found that because of its size, location, etc., conventional financing was the only route open to us. Farmers Home Administration, along with state and/or federal grants were not available to our district.

After you get your financing, begin working with your contractor on setting start and completion dates. The construction phase is the easy part of the project if you did your homework during the planning phase. If you didn't make two many mistakes, the project only costs twice as much as it should. Close cooperation with your contractor can reduce the costs of some mistakes; six yards of concrete poured, two inches higher than required grade may be a little expensive to fix. Good working relations with your contractor can head off a lot of problems. Watch for problems and be prepared to react to resolve them.

In conclusion, planning is the key to success in any upgrade project. The MRWA and WQB can't do the planning and engineering for you but they can be extremely helpful. Don't hesitate to call on them.

Continuing Education Credit Update

BY ROSEMARY FOSSUM, OPERATOR CERTIFICATION, WQB

By June 30, 1988, Class 1-4 fully certified operators who were certified before October 1, 1986, will need to report continuing education credits for renewal of their certification. An amazing 450 operators have already reported their attendance at some 31 department-approved training sessions.

The department has encouraged and received course offerings from a variety of sources. Northern Montana College, Montana Tech, and Montana State University as well as the Montana Rural Water Association and the Water Quality Bureau have presented or jointly presented courses for credit. The cities of Helena and Billings have organized in-house training for their operators on such subjects as chlorine safety; power failures and restoration procedures; and pump packing maintenance and selection. Waterworks Inc., with Rockwell International, has presented a meter school for CEC credit in Plentywood and expects to repeat the school in other locations. AWWA-WPCF Joint Education Committee has sponsored Terrex Industries and Mueller Company in courses on water distribution and telemetry. Correspondence courses from California State University at Sacramento; Michigan State University at East Lansing; and TPC Training Systems of Barrington, Illinois have been approved. The Billings Area Indian Health Service has an approved wastewater operator training program using the Sacramento course as texts and the City of Billings is considering something similar.

Applications for approval of training for continuing education credit are now available from the certification office. All providers of training for continuing education credit must submit an application showing such information as the educational and experience background of the instructor(s) and a complete outline of the course content. Course instructors who are certified operators will be credited with the CEC's approved for the course plus .25 CEC's for courses less than 5 hours in duration and .5 CEC's for courses 5 hours or more in duration. Those training providers who submit applications for approval of training for continuing education credits by December 1, 1987, will be listed in the 1988 Training Calendar which is sent to all operators.

Credit Report Forms are available from the certification office or wherever a course is taken and should be fully completed with all the information requested to assure proper CEC credit is given. The Water Quality Bureau encourages operators to suggest training providers who may wish to apply for approval of their courses for CEC's. Operator suggestions regarding training subjects and locations would also be helpful.

Drinking Water Law Revised

By: Dave Durenberger
U.S. Senator (R-MN); Chairman of House-Senate Conference Committee for the Safe Drinking Water Act Amendments of 1986.
(Reprinted from EPA Journal)

The need for a national statute to protect public health from drinking water contaminants was first recognized by the Congress in 1974 only after surveys by the Environmental Protection Agency (EPA) had shown that public water supplies were widely contaminated with synthetic organic chemicals, the new man-made compounds that have revolutionized every facet of American life in the last half of the 20th Century. Whatever miracles these new chemical substances have produced at home or in the workplace, their presence in drinking water supplies was suddenly recognized as a substantial threat to the nation's health.

The theory of the Safe Drinking Water Act is quite simple. The program has two parts. First, EPA is to establish national standards for drinking water quality. These standards are numerical criteria for each contaminant that may be found in a drinking water supply and that has or may have an adverse effect on health. The EPA standard is the maximum concentration of the contaminant allowable. At the time the Safe Drinking Water Act was adopted, more than a dozen such standards, principally for metals and other inorganic elements, had been established by the Public Health Service. EPA was to fill out this list rapidly with Maximum Contaminant Levels (MCLs) for a wide range of other pollutants.

The second part of the theory of the drinking water program is that water suppliers, the operators of the 60,000 public water systems in this country will monitor the quality of the water delivered to consumers and treat that water if necessary to assure that the concentration of each contaminant remains below the acceptable levels established by EPA.

The theory of the Safe Drinking Water Act is appropriate to our federal system of government. The central, national government conducts the research on health effects and treatment technologies necessary to set standards that will provide adequate protection of public health. And local governments, which most often own and operate the water supply systems, put the standards into practice by applying them to the water they deliver to the American people.

The Safe Drinking Water Act is, indeed, simple in theory. In fact, Congress expected the program to fall quickly into place. The original statue is replete with deadlines stated in mere days from enactment...60 days...90 days...180 days.

But it is now 12 years later and most of the original promise of the law remains unfulfilled. In all of the time that has elapsed since enactment, the EPA has set standards for only a handful of contaminants.

Seven hundred different organic, inorganic, biological and radiological contaminants have been detected in the drinking water supplies of the United States. And yet today after 12 years under the Safe Drinking Water Act we have standards for only 22 contaminants.

Because EPA set few standards, water systems at the local level have not monitored for the broad range of contaminants likely to be found in water supplies. Even for those standards that are in place, it was soon discovered that most public water systems were woefully unprepared to implement the measures required of them by the drinking water law. In 1981, the General Accounting Office (GAO) conducted a study of compliance by local systems with the requirement of the Act. The requirements are principally of three types: to monitor supplies of the contaminants for which EPA has set standards, to report to the consumer if the standard is exceeded, and to take steps to come into compliance with the law--to treat contaminated water--if existing quality does not meet the national standard. GAO had a great deal to report.

The record of the drinking water program at the local level is a match for our experience at the national level of government. It is not a happy record. Violations are not in the hundreds. Violations are not in the thousands. GAO found that each year violations of the Safe Drinking Water Act by local public water suppliers number in the tens of thousands.

The failure of the program at the local level is in large part understandable. The operation of water supply systems in most small towns is not a space-age science. While the number of chemicals used in daily life has exploded, there has been no comparable revolution in the capacity of small communities to protect their water supplies from these new chemical contaminants. Water supply is public works. Many towns still don't charge consumers for water. Few small towns can afford to pay a water engineer full-time to run the system. Management is quite often done by a volunteer who is not by training or inclination part of the theory of the Safe Drinking Water Act.

So the job did not get done in 90 days in 1974.

On June 19, 1986, the President signed into law a new drinking water program which passed both houses of the Congress by overwhelming margins, but only after three long years of study and debate. The 1986 Amendments go beyond the simple two-part program of the original law and include a series of protection strategies. The Amendments do not depend only on swiftly established federal standards and technically sophisticated local water systems. Instead, the Amendments build multiple layers of protection which can be seen in the following four-part summary of the new law.

Standard-Setting. First, EPA is required to establish standards for a list of 83 named contaminants within a three-year period. The Agency is already well along in the Standard-Setting process for these contaminants. The Congressional mandate is intended to assure that the drinking water office will get the resources and support that it needs to complete the task as soon as possible. The 1986 Amendments are also designed to simplify the standard-setting process in the future establishing a technology-based benchmark for MCLs. One specific treatment technology, granular-activated carbon, is identified as an available and appropriate treatment technique to be used in setting MCLs for synthetic organic chemicals.

Monitoring for Unregulated Contaminants. Even with the new standard-setting process, it will be difficult for the regulatory process to keep up with the chemical revolution. To assure adequate protection of our drinking water supplies, the 1986 Amendments will require local water supply systems to monitor periodically not only for contaminants with MCLs, but for a broad range of other contaminants as well. Over the next two or three years, hundreds of small towns will be surprised to learn that their drinking water wells have been contaminated by unpronounceable chemicals that they had never been warned about. Armed for the first time with adequate information, these communities will, without heavy-handed federal regulation, take the steps necessary to protect their drinking water supplies. We are confident of this result because programs to monitor for unregulated contaminants have been conducted in a few states already and with great success.

Treatment and Protection. The third part of the new provisions includes steps to protect water supplies from contamination and to treat all supplies before distribution. EPA will mandate filtration and disinfection, or steps equally protective, for all systems to remove contaminants. And the legislation includes two new grant programs directed to state and local governments prepared to take steps to protect ground-water resources.

Technical Assistance. The 1986 Amendments include significant programs of technical and financial assistance for small systems that would otherwise not be able to fulfill their role in the drinking water program. For instance, EPA is authorized to spend $30 million aiding small systems with monitoring requirements for unregulated contaminants. EPA will pay for the analysis for systems serving under 150 connections and may even provide technical aid in drawing the samples. The Amendments also include grants for states to manage the water supply and ground-water protection programs, grants for small systems and technical assistance to implement the disinfection requirements.

Although the 1986 Amendments to the Safe Drinking Water Act are modest in scope, we in the Congress believe they contain the elements to bring the theory of the Safe Drinking Water Act closer to the reality of the human institutions that must deliver, day-to-day, the important public health protection it promises...safe drinking water for all Americans.

And the Waters Came

By: Marlene Doney, Chief Operator, Chinook WWTP and
Doris Roberts, NMC

If you ever experience a flood at your wastewater treatment plant, the procedures used at the Chinook plant may be of help.

The sky darkens. Drops of rain start to fall, and fall, and fall....................

The flow at the plant starts to increase. Our normal flow is 0.165 MGD. The plant is designed for 0.5 MGD so we have a cushion. But now the flow is 0.7 MGD. The flow leaving the ditch is getting high enough to cause the mixed liquor to go over the bypass (straight to the disinfection building and out), and the flow is too much for one UV unit. No big problem, get a board to block the bypass, and open the gate for the other UV unit so that each one is only taking half the flow. Now sit down and breath easy; remember things could be worse. After all, the flow is starting to go down. All will be ok. Or will it?

What's this? The flow increasing again! 0.6...0.7...1.0.......over 2 MGD. How much over? Who knows? Everything seems to be buried under water. The mixed liquor in the ditch is being washed out. The UV units are overloaded. The clarifier is near flooding, and the only way to get to the plant is by boat. Thoughts of Noah come to mind, but building an ark, though tempting, is not the solution.

What is the solution? First know your priorities, and then follow with actions. The priorities:

1. long term permit compliance
2. prevent structural damage;
3. save the mixed liquor.

With the first priority set, the second and third fell right into place. If the plant is damaged or the mixed liquor is lost, a few days of being out of permit might very well turn into months.

With the priorities set, action follows--

1. Shut off the UV lights and open the bypass. Now the flow is going through both UV units and the bypass pipe. To handle the quantity of water, three pipes are better than two.

2. Put the plant in primary mode--the ditch is bypassed. The effluent from the grit chamber is gong directly to the secondary clarifier which is now serving as a primary clarifier. Now the mixed liquor is isolated in the ditch.

3. Every 12 hours, stop the ditch rotors and let the mixed liquor settle. Now have the effluent go to the ditch again. The new food will push the old out (remember, the microbes have to eat). After a couple of hours, go back to primary mode and start up the rotors again.

4. Periodically waste the heavy grit that settles to the bottom of the clarifier directly to the aerobic digester. There is a large quantity of grit coming in, and the velocity through the chamber is high. We don't want the grit that is getting to the clarifier to stay in the system.

5. Man the plant 24 hours a day until the emergency is over.

6. Notify the Water Quality Bureau of the problem and the procedures being taken to meet it.

7. Write all the flood procedures in a permanent record--floods can happen more than once.

A few days have passed, and the waters have receded. Only minor damage to one UV unit. Most of the mixed liquor is where it should be, in the ditch, not the river.

The operators who manned the plant and handled the emergency, Marlene Doney and Drue Newfield, are tired but happy. Happy that the plant had the flexibility that was needed, and happy that they had met the challenge.

If you are unfortunate enough to have a flood, the procedures used at the Chinook plant may help you deal with it. But remember, if you have to take any of the actions described above, notify the people at the Water Quality Bureau. They are vitally interested in the quality of effluent leaving your plant, but they know that there are times when the circumstances are beyond your control and complying with permit requirements is impossible. We have found that not only are they understanding, but also they can give you valuable advice.

How to Raise A Manhole Lid, Simply

By: Lawrence J. Curles, P.E.,
City Engineer,
Port Orchard, Washington
Reprinted from Public Works for
August, 1986

If road surfaces were level, raising manhole lids would be simple. Unfortunately, road surfaces are never level--making a chore out of what would appear a simple operation. An old town, with its old road, has an infinite variety of geometric surfaces. And, no matter how hard you try, that lid will never be raised in the right manner to fit into the existing surface of the street.

Port Orchard is trying to reduce stormwater infiltration into its sewer system. An obvious solution was to raise the existing manholes (which were depressed below the street surface) so that they would cease acting as storm drains. We tried a variety of methods.

Commercial manhole lid raisers did not fit our irregular road geometry. No matter what was tried, there was always one side of the lid that left a lip on the travel surface. We tried using asphalt to raise and secure the lid. However, asphalt was not durable enough and rapidly cracked around the lid. Also, asphalt was not always available because the plants close during inclement weather--no rare occurrence in the Pacific Northwest.

Fortunately, the assistant superintendent of public works developed a simple and economical method to raise manhole lids, no matter what the condition of the road surface. The procedure requires only two men, a jackhammer, a piece of 18- by 80-inch sheet metal, two screw jacks and a minimal amount of concrete. The procedure is as follows:

1. Using the jack hammer, cut the road surface away from the existing lid. Typically, the road surface would be cut 8 to 12 inches from the lid's frame.

2. Place the sheet metal into the manhole frame opening and shape the sheet metal in a circular configuration. The metal will serve as a concrete form. Use the two screw jacks inside the sheet metal to brace the metal and to get a good circular form that will not distort.

3. Position the top of the sheet metal as necessary to get the correct lid elevation.

4. Once the sheet metal form is in place, concrete is put in the excavated area. On this concrete and over the form, place the manhole frame. Enough concrete should have been prepositioned so that the frame is about 1/2-inch higher than the desired elevation. The frame is then tapped into place and more concrete is poured in the excavated area around the lid. The lid is

placed on the frame when the concrete has set enough to support the extra weight. The frame has been raised and the time consuming effort of placing blocks under the frame has been eliminated.

Typically, you will only need 3 to 5 cubic feet of concrete per manhole. We have discovered that a concrete batch plant will sell this small amount at a reasonable price if you pick it up at the plant. The city uses an old 55-gallon barrel in a pickup truck to get its concrete. The concrete can then be trowled to conform with whatever irregular surface the road may present.

In this manner, two unskilled employees can rapidly raise a manhole lid and provide a durable product. The concrete should set for two days and will resist all the punishment that the road and the environment can deliver.

Correspondence Courses Available

CORRESPONDENCE COURSES APPROVED FOR CEC'S TO DATE:

Supervisory Management in the Water/Wastewater Field CEC: 6. For WT and WW. Cost: $100. Contact: Clark E. DeHaven; 7 Olds Hall; Michigan State University; East Lansing, Michigan 48824-1047. Phone: 517-353-8711.

Maintenance Management in the Water/Wastewater Field CEC: 6. For WT and WW. Cost: $65. Contact: As above.

Water Treatment Plant Operation, Volume I and II. CEC: 9. per volume. For WT. Cost: Manual, $30 per volume. Enrollment, $40 per volume. Contact: Kenneth Kerri; California State University, Sacramento; 6000 J. Street; Sacramento, California, 95819-2694. Phone: 916-278-6142.

Water Supply System Operation CEC: 9. For WD only. Cost: Manual, $30, Enrollment, $40. Contact: As above.

Operation of Wastewater Treatment Plants, Volume I and II. CEC: 9. per volume. For WW only. Cost: Manual, $30 per volume. Enrollment, $40 per volume. Contact: As above.

Electrial Systems Course Series, 201 through 210 CEC: 2. per course number. For any classification. Cost: $37.50. Contact: Patricia Horn; TPC Training Systems; 1301 South Grove Avenue; P. O. Box 1030; Barrington, Illinois 60010. Phone: 312-381-1840.

Water/Wastewater Treatment Course Series, 381 through 383. CEC 1. per course number. For WT and WW. Cost: 25.50. Contact: As above.

Gate Valves

Operation and Maintenance

By: Dick Seevers, Mueller Company
(Reprinted from Opflow)

Water distribution systems consist of a network of interconnected underground pipes. Sometimes the pipes in the system must be isolated--that is, water flow must be shut off at several points in the system so that a particular section of pipe will not receive water for a period of time.

Distribution pipes are isolated mainly to check for and repair breaks in the pipes. Pipes are also isolated during general operation of the system and to shift flow to different pipes.

The devices most commonly used to isolate distribution pipes are double-disc gate valves (see Figures 1 and 2). In the double-disc gate valve, two circular discs (gates) are lowered in the valve body to block water flow. As the gates approach their closed position in the valve, a wedging mechanism between them forces them against their parallel seats to shut off flow. (See Figure 3.)

The wedging mechanism varies with different brands of double-disc gate valves. As a result, operators may receive a different "feel" through the valve wrench when turning the operating nut (depending on the brand of valve). Operators should study the internal construction of the particular brands of double-disc gate valves used in their system. This will help them understand how the pressure exerted when opening and closing the valves affects the internal operation of the valves. If too much pressure is exerted, damage to the valve can result. If too little pressure is exerted, water shut-off will not be achieved.

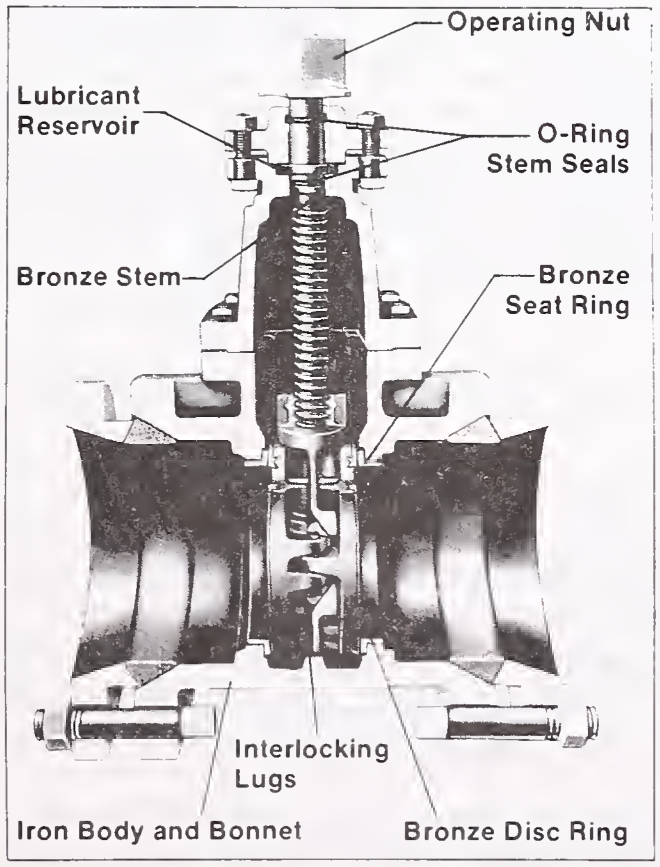


Figure 1 Cutaway view of double-disc gate valve showing the internal working parts.

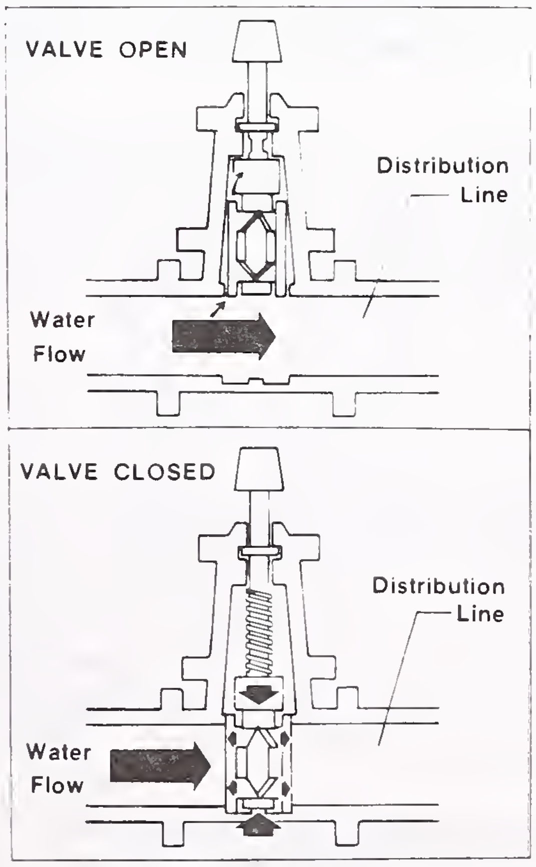


Figure 2 Double-disc gate valves serve as small dams in distribution lines.

All double-disc gate valves used in distribution systems should meet the standards set forth in AWWA C500-80, Standard for Gate Valves, 3 Through 48 In. (Nominal Pipe Size), for Water and Sewage systems. As stated in the standard, the body of gate valves should be made of iron, and the seat rings, disc rings and stem should be made of bronze. Since these valves are buried, the stems should be nonrising--that is, they should be enclosed inside the gate valve bonnet.

Valve Records

Proper installation of double-disc gate valves is very important. To assure proper installation, manufacturers' instructions should be carefully followed. During installation, the valve box should be centered over the valve operating nut. The valve box should be installed in a vertical position and should not be in contact with either the valve body or the distribution pipe.

At the time of installation, accurate records of each gate valve installation should be prepared. These records should consist of as-built maps and individual record cards for each valve. Valve record cards (Figure 4) should include (1) the location of the valve in the system, (2) the make of the valve, (3) the number of turns required to open the valve, (4) the direction in which the operating nut should be turned to open each valve, and (5) any other information that may be useful.

When recording the location of the valve, describe the location in precise detail, using at least two permanent installations as reference points. As an example, the location of a certain gate valve could be described on a valve record card as follows: "19 ft (6 m) due west of the fire hydrant on the northwest corner of the intersection of Littleton Rd., and Sunset Ave., and 41 ft (15 m) due south of the meter box at 740 Littleton Rd."

By keeping accurate records (both maps and cards), valves can be readily located in an emergency. To be sure that cards remain accurate, keep all maps and cards up to date.

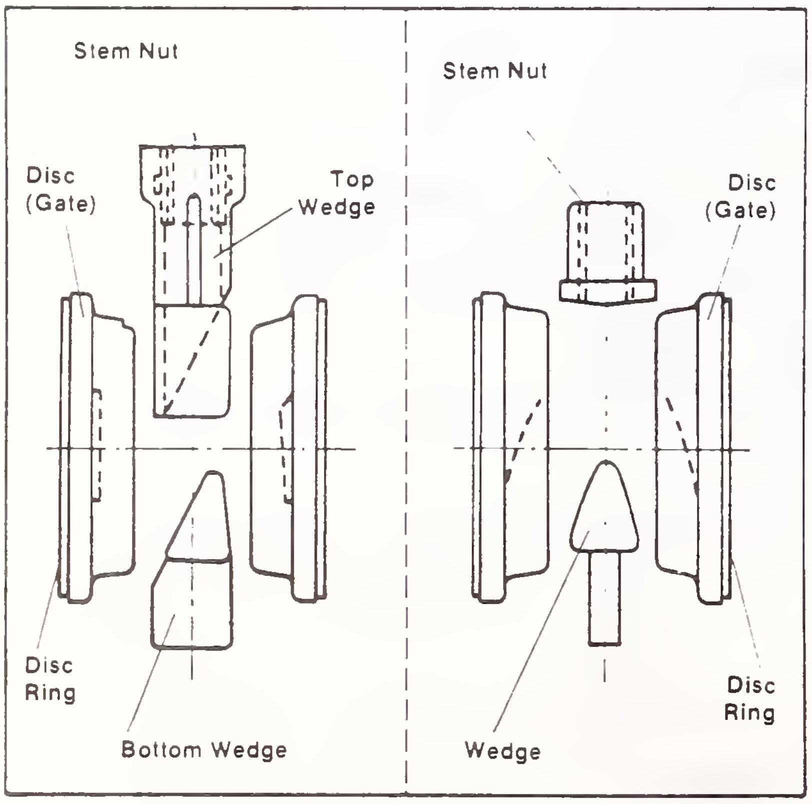
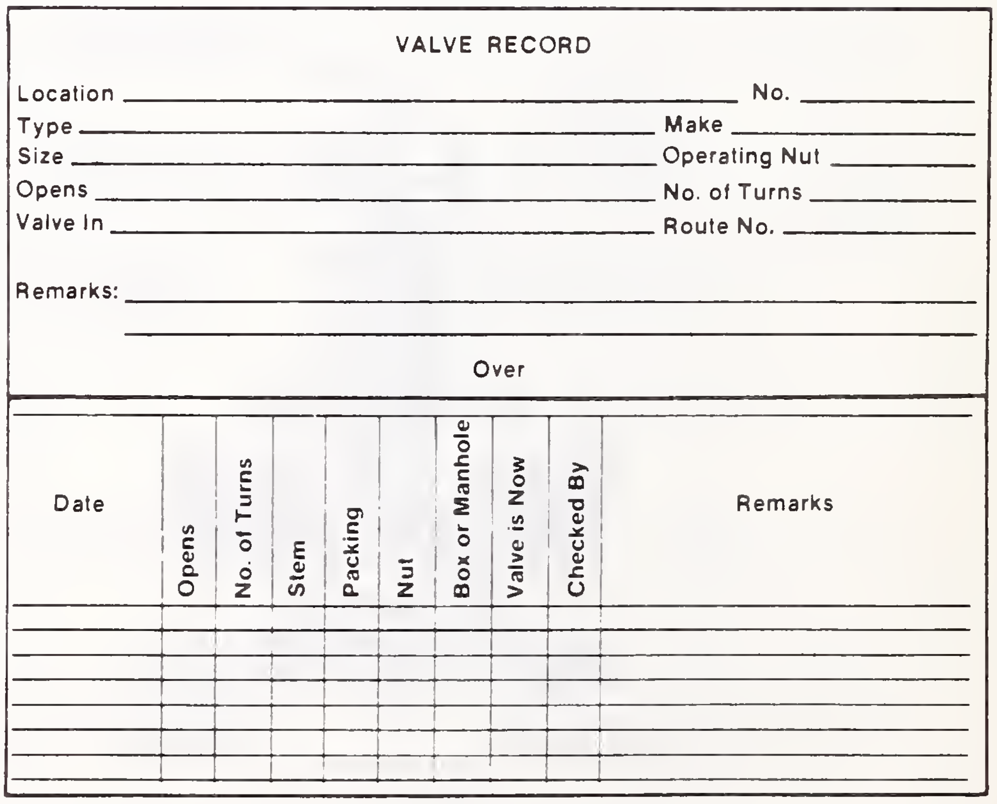


Figure 3 Various types of wedging mechanisms force discs (gates) against their parallel seats to shut off flow.



VALVE RECORD

Location ______________ No. ______
Type ______________ Make ______
Size ______________ Operating Nut ______
Opens ______________ No. of Turns ______
Valve In ______________ Route No. ______

Remarks: ______________

Over

Date	Opens	No. of Turns	Stem	Packing	Nut	Box or Manhole	Valve is Now	Checked By	Remarks

Figure 4 Front and back of a valve record card. Such cards should be used to record important information about each valve in the system.

Maintenance Program

To assure proper operation, valves should be inspected and maintained on a regular basis. A good maintenance program includes (1) checking the operation of each valve, (2) verifying each valve's location, (3) checking the condition of valve boxes, and (4) making sure that a valve wrench will have free access to each valve's operating nut.

Sometimes, foreign material or mineral deposits (incrustation) will build up on the internal working parts of valves. When incrustation builds up on valve parts, the valves may not close completely. To keep internal working parts free from the buildup of incrustation, all double-disc gate valves should be exercised on a regular basis.

To exercise valves, the gates should be raised and lowered to feel if operation is smooth and easy. When doing this, operators should count the number of turns required to open and close each valve. The number of turns should be the same as the number listed on each valve's record card.

How often to exercise valves will depend on several factors, such as the rate at which incrustation builds up on the internal working parts and the age and type of valve used. As a general rule, each gate valve should be exercised at least once a year. Gate valves installed in critical locations should probably be exercised more often.

If gate valves have been neglected for a long period of time, closing the valve reasonably tight during exercising may be difficult due to a buildup of incrustation. If this problem occurs, extra exercising will be required to restore proper operation.

When extra exercising is needed, first close the valve with a reasonable amount of torque (force). This action will loosen some of the incrustation that has built up on the internal working parts of the valve. Next, relax the pressure being exerted on the valve to allow the loosened incrustation material to be washed away. If practical, flush the loosened debris through a nearby hydrant. After relaxing the pressure, reapply pressure to the valve.

This procedure should be repeated as many times as needed to free the internal working parts and sealing surfaces of incrustation and to allow a reasonably tight shut-off for each valve.

In the valve-exercising program, operators should (1) remove any rocks and dirt that may be in the valve box, (2) make sure that the valve box lid is in place, and (3) make sure that the valve box is at its proper height. These procedures will help assure that the valve will be ready for use in an emergency.

Repairs

Repairing in-line (installed) gate valves is a difficult task. If repairs are needed, proper advance planning is important. The valves needing repairs must be located. The valves that will be used to isolate the damaged valve must be in good operating condition. The necessary repair parts must be obtained in advance. (When ordering repair parts, be sure to include the size, make, direction of opening, year of manufacture and other pertinent information in order to assure that the proper repair parts will be received.)

It is difficult to determine what part of the valve is damaged until the valve is opened up. Therefore, make sure that all replacement parts are on hand before isolating the necessary section of distribution line, excavating the valve and attempting to make repairs.

It is possible to repair and reuse a damaged valve. After a damaged valve has been replaced, it should be disassembled and examined. If broken parts of the valve can be replaced and if the overall condition of the valve is good, the valve can be completely reconditioned and reused.

Successful Year for AWWA

By: Robert G. Millons

As 1986 comes to a close so does a very successful year for AWWA. The June AWWA Conference in Denver, Colorado had the largest attendance ever. There were over 9,600 people registered. In addition to an increase in attendance, there was an increase in the number of display booths for products and equipment.

The association surpassed its membership goal of 40,000 members. There were 41,646 members at the end of November. The American Water Works Association continues to grow and improve its position as the world's leading water authority.

Some of the highlights of the Board of Directors meeting on June 22nd and June 26th are as follows:

Approved amendments to the section by-laws for New York, Ohio, Pennsylvania, South Dakota and southwest sections.

Approved the following annual conference sites:

1989 Los Angeles, California
1994 New York, New York
1995 Anaheim, California

Approved committee appointments for 1986-1987.

Approved a schedule for the Statement on Drinking Water Quality to be completed by January 7, 1987.

Approved the following AWWA policy statements:

A. Metering (reaffirmation)
B. Discontinuance of water service for non-payment (reaffirmation)
C. Recreational use of domestic water supply reservoirs (revision)

Approved the strategies' plan for 1987-1991. The plan will be printed in the Journal and the Officer and Committee Directory.

In addition to the above actions approved by the Board of Directors, several items are being considered and implemented which directly affect Montana:

A small systems committee has been formed and was given priority to solve the problems facing small systems. The new Safe Drinking Water Act will be a major concern for Montana.

Several proposals will be considered at the January 1987 Board meeting to increase the allotments to small sections.

The candidates for Vice-president have all expressed a concern for small systems and intend to implement good strong programs to assist small systems.

The June 30th national financial statement indicates that this year has every indication of being another banner year for AWWA. Interim financial statements show that we are on target for another strong year financially.

Water Fleas Used for Toxic Control

By: Mark Kerr, Water Quality Bureau

A small pond organism about the size of a pinhead is rapidly becoming one of the major players in the detection and control of toxic substances in the nation's discharges and their receiving waters. This organism is Ceriodaphnia.

Ceriodaphnia and its many relatives are commonly called "water fleas." Scientists refer to them as "cladocerans" because they belong to the order Cladocera within the class Crustacea. This class includes such organisms as lobsters and crayfish. Some wastewater technicians may be more familiar with Ceriodapnia's cousins Daphnia and Moina, which occasionally turn sewage lagoons red in sudden population explosions. Daphnia has also been used extensively in toxicity studies for many years.

Why then has Ceriodaphnia been making a name for itself? Much of the credit really belongs to the U.S. Environmental Protection Agency (EPA). Ceriodaphnia, the fathead minnow Pimephales promelas, and the green alga Selenastrum capricornutum have been promoted as the test species in EPA's toxic substances control strategy.

Ceriodaphnia has several favorable attributes which make it an excellent organism for bioassays: high sensitivity to many toxic substances, abundant reproduction, and a relatively short life cycle. The equipment required to conduct a Ceriodaphnia bioassay is readily available in most laboratories--a microscope, incubator, beakers, eyedroppers, pH meter, dissolved oxygen meter, and other accessory equipment. Finally, almost anyone can maintain a culture of Ceriodaphnia. A couple of one-liter glass beakers, clean stream water, and a prepared food diet of cereal leaves, trout chow, and yeast are all that is required to keep a population thriving.

The bioassay procedure is relatively simple. Nearly all Ceriodaphnia grown in culture are females which reproduce asexually. Newly released young (neonates) are introduced into small beakers of various test solutions, such as effluents, effluent dilutions, or ambient stream water. For seven days, the original test organisms are transferred daily into beakers of newly collected test solutions and fed the prepared food. Mortality and production of young, key indicators of toxicity, are noted daily.

Under favorable conditions, an organism will release its first brood of young on the fourth test day. At the end of the seven-day test, three broods will have been released. The first brood may number four to six young the second brood eight to 12 young, and the third brood 12 to 18 young. Chronic toxicity is indicated by depressed brood size. Of course, the toxicity may be so severe that test organisms die before reproducing.

The Montana Water Quality Bureau has conducted three bioassays using Ceriodaphnia. In August, ambient water from the Yellowstone River in the vicinity of Laurel and Billings was tested, as were the major discharges in these areas. While some of the discharges were found to be toxic, no toxicity was indicated in the Yellowstone River. Two bioassays were conducted in 1985, on water collected from the Clark Fork River above and below Milltown Dam near Missoula and on creek and tailing pond water collected in the vicinity of the ASARCO copper-silver mine near Troy. EPA used Ceriodaphnia in bioassays conducted during the environmental impact study for the Champion International (now Stone Container Corporation) Frenchtown Mill discharge permit.

Although EPA-Region VIII is still finalizing its toxics control strategy, it seems likely that Ceriodaphnia will become a very familiar name to persons with careers in water quality in the years ahead.

Metering the Small Water System

By: Tom Hanson, Engineer with Professional Consultants in Missoula

Potable water is rapidly becoming recognized as a precious national resource of limited supply. The cost of delivering this resource to the consumer has increased dramatically for several reasons:

1. Clean, quality water sources are fewer and farther away.
2. More rigid quality standards require more extensive treatment.
3. Increased cost of electricity directly affects pumping and treatment.
4. Increased labor costs directly affect production and maintenance.

Clearly, most of the cost of delivering water is proportionate to the quantity delivered. Any reduction in delivered quantity is a direct savings in cost. The fact that less water is consumed from a metered system is well documented and meters have long been recognized as a way of keeping careful inventory on water use. Meters assure that the cost of producing and delivering water is equitably shared by the users.

Agencies funding and directing water system projects are strong advocates of metered systems. Meters are virtually required for projects funded by Farmer's Home Administration grants or loans.

WHY METER?

Costs can be assessed on the basis of quantity consumed.

The result of this simple principal is conservation of water due to an awareness of water used and wasted. This prompts the repair of leaks in household service lines and the water mains making up the distribution system.

The effect of water conservation is a direct reduction in pumping and treatment costs. A very important but less direct effect is the postponement of plant expansion in the form of less supply required (i.e. fewer wells, smaller pumps), smaller transmission mains and smaller storage reservoirs.

Several studies and reports on systems around the northwest area of the U.S. consider metering to reduce water consumption by 25% to 50%. A report in 1981 for Mountain Water Company of Missoula projected a decrease in average residential consumption of 27%. Peak flow savings were anticipated to reach 50% due to a more conscientious use of irrigation water in summer months. Joseph A. Salvato, Jr., in "The Design of Small Water Systems" considers metered residences to use 25% to 100% less water than un-metered.

ESTIMATING THE BOTTOM LINE

Responsible water system owners and operators are usually first interested in the bottom line--what is the cost of metering our system?

The ultimate cost of metering a system is the direct cost of the meters less the value of the savings from conservation. This may be expressed as:

Net Cost = Meter Costs - Metered Savings

Meter costs include the direct capital cost of purchasing and installing the meter, valving, and pits as required for the system as well as the operation and maintenance cost attributable to the meters.

Metered savings due to conservation include reduced production, treatment and storage costs. Each system across the state is unique in its costs for water production and delivery, and a reasonable estimate of savings expected depends upon accurate data for production costs.

You should begin by gathering information on your system. As a minimum the following data is needed:

1. Number of residential sized users.
2. Number and estimated usage of commercial customers.
3. Current annual or average daily water production.
4. Current cost of production (include such things as power, chemicals, supplies, depreciation expenses and labor).

METER COSTS

1. Capital Cost

Several factors will affect the cost of retro-fitting your system with meters. The use of outside meter pits located at the property line leaves the consumer responsible for leakage in the service line and, except for weather considerations, leaves the meter accessible at all times for reading and repair. Installation of meters in older homes can be difficult to plumb and locate but remote read-out devices can make reading the meter convenient.

Expect residential meter installations to cost from $350 to $400 if a pit is used and expect inside installations to cost about $250 per meter inch. These costs are obviously general in nature and your supplier or engineer can help you with more accurate cost estimates for your situation. An additional 20% should be added to include contingencies and engineering costs.

Assuming an installation is fully amortized over 20 years at 8%, the cost for a residential meter and pit is about $3.40/month.

2. Operation and Maintenance Costs

For many small systems in this state, meter reading and billing can pose a significant apparent increase in their operations costs. Small towns may have to hire a part-time person just to read meters. Many systems are operated through a water district or an improvement district that is funded annually by property taxes. These systems have no office or bookkeeping facilities and billing costs are actually supported by the county.

In order to estimate the cost of operation and maintenance, assume monthly meter reading and billing by part-time or contract labor.

> Most authorities suggest that water meters have a 15 to 25 year life. A reasonable estimate is that the meter will be replaced in 15 years and take 2 hours of labor to do so. Replacement cost of a 5/8" x 3/4" meter today is about $45.00. If labor costs are $20.00/hour then today's O&M cost becomes:
>
> $45.00 + (2 x $20.00) = $85.00/15/12 = $0.47/month.

It can be estimated that the meters may be read at the rate of 5 minutes/meter. If part-time labor at a cost of $7.50/hour is used to read the meter, the meter reading cost is: $7.50 x 5/60 = $0.63/month.

Accounting costs will be estimated by assuming a clerk will take 3 minutes per billing at a rate of $10.00 per hour resulting in $10.00 x 3/60 = $0.50/month. Postage, paper and supplies should add another $0.50/month/meter.

Total O&M may be summarized:

Replacement and maintenance	$0.47
Meter reading	0.63
Accounting/Billing	0.50
Postage/Supplies	0.50
	$2.10/meter/month

The total meter cost becomes:

Capital cost	$3.40
O&M cost	2.10
	$5.50/month

Metered Savings

Many factors enter into the potential for cost savings when water is conserved. Besides the obvious savings in reduced production and treatment costs, postponement of plant expansion (i.e., the need for additional well capacity or the need for added storage volume) is a real benefit of water conservation. These potential savings require an in-depth study of each system, reasonable growth projections, and analysis of existing and future requirements. Although these savings are real and significant, they are not the major portion of savings for the small water system and will not be considered here.

Production costs will range widely from system to system depending upon the source of supply and treatment costs, if any. One western Montana system producing about 54 million annual pumped gallons, delivers water for about $0.225 per 1000. A larger system pumping well water with chlorination required about $0.40 per 1000 gallons.

To get an approximate idea of your production costs, add together your annual power costs, chemicals and treatment supplies and estimate your labor costs in production. Divide this by your number of connections then by twelve to reach a monthly production cost per consumer. Next make your best guess as to the water conserved by metering the system. As stated earlier, savings of 25% to 50% can be expected. Savings will depend upon the amount of leakage you are currently experiencing and the use habits of your consumers.

For purposes of this example we will assume an average monthly use of 20,000 gallons per connection unmetered and a 33% savings of 6,600 gallons after metering. If cost of production is $0.25/1000 then the resulting savings are $1.65/month. The initial net cost for metering is:

Net Cost = $4.72 - $1.65 = $3.07/month.

LONG TERM SAVINGS

Please note from the aforementioned example, that after 20 years, the capital cost of metering is gone and the net cost is reduced to the cost of O&M less the value of the savings, or about forty five-cents per month in this case.

Because the cost of water production is usually dependent upon the cost of electric power and the cost of water treatment required to meet new and changing regulations, it is reasonable to expect that the cost of water production will increase at a rate greater than the cost of operations, maintenance and billing. Figure 1 shows that the value of the conserved water in our example soon is much greater than the cost of O&M and billing when production costs increase at 5% annually and O&M costs increase at 3% annually.

The true cost of metering must consider the long range value of water conservation as well as the initial capital cost of the meter and maintenance program.

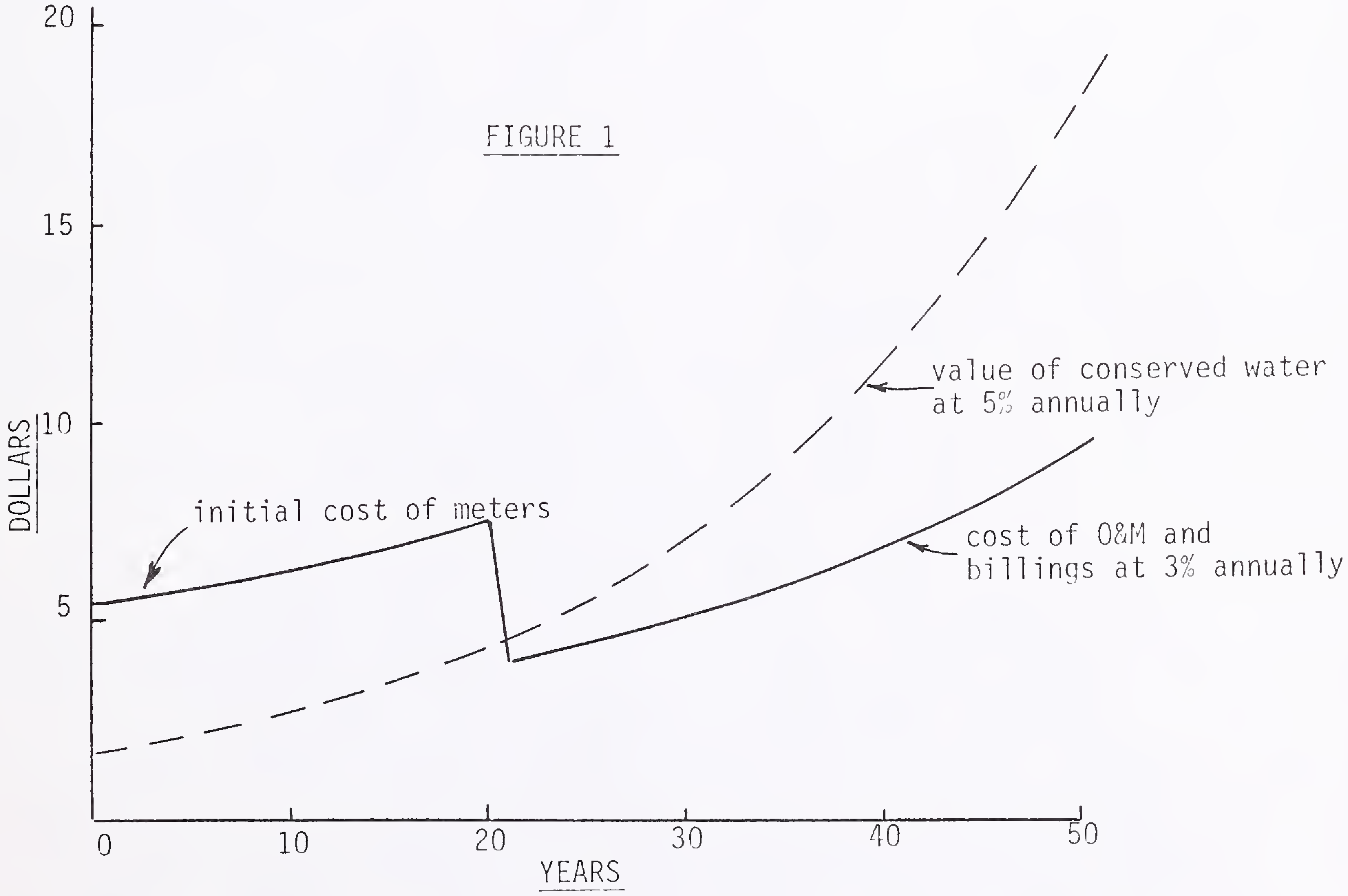


FIGURE 1

TRAINING COURSES HELD AT IDAHO CONFERENCE

The Sixth Annual Conference of the Idaho Section of the PNPCA (Pacific Northwest Pollution Control Association) will be held in Coeur d'Alene May 18-20 and will offer a variety of training courses for which application for approval of training for CEC will be submitted. Contact person: Tom Liston, Supt. of Wastewater Treatment Plant; 710 Mullan; Coeur d'Alene, ID 83814. Phone: 208-667-9533.

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